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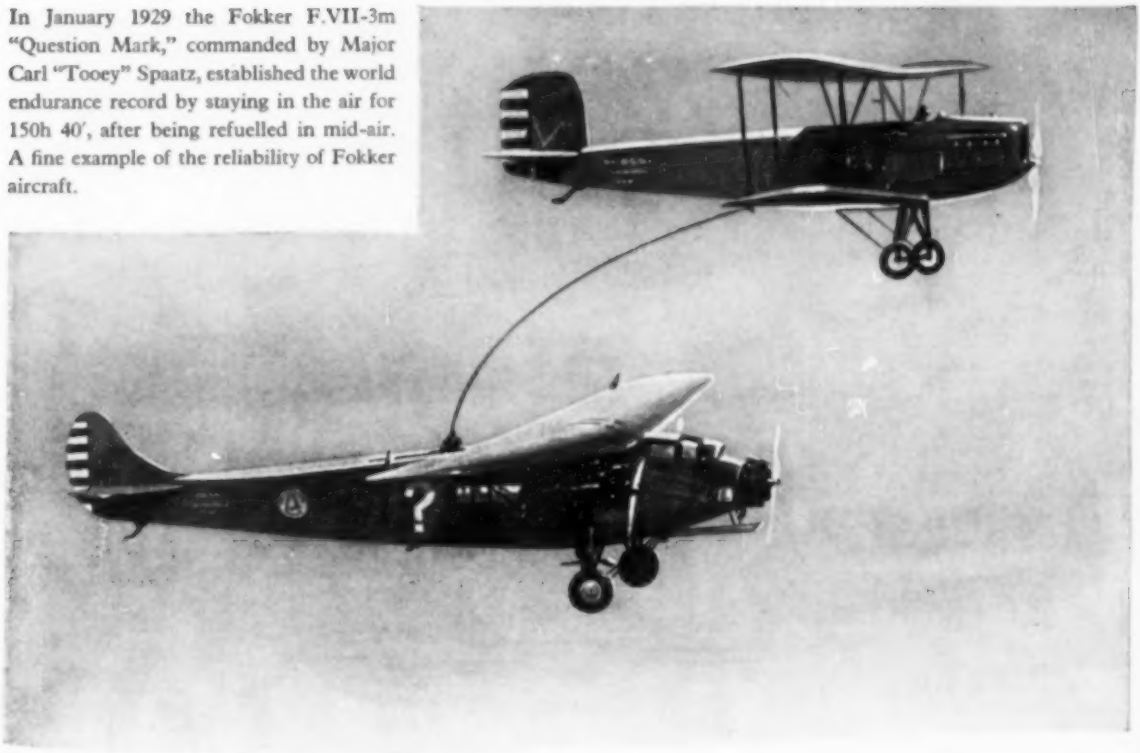

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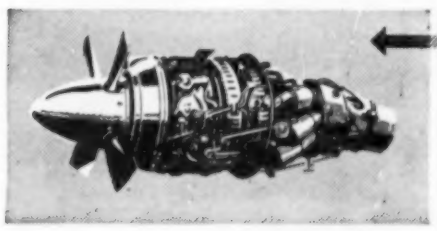

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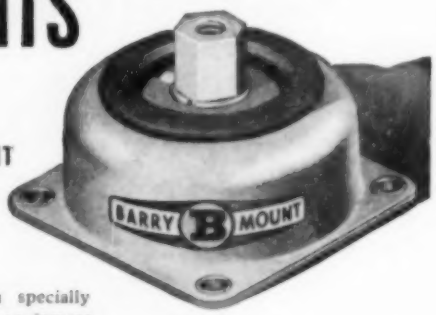

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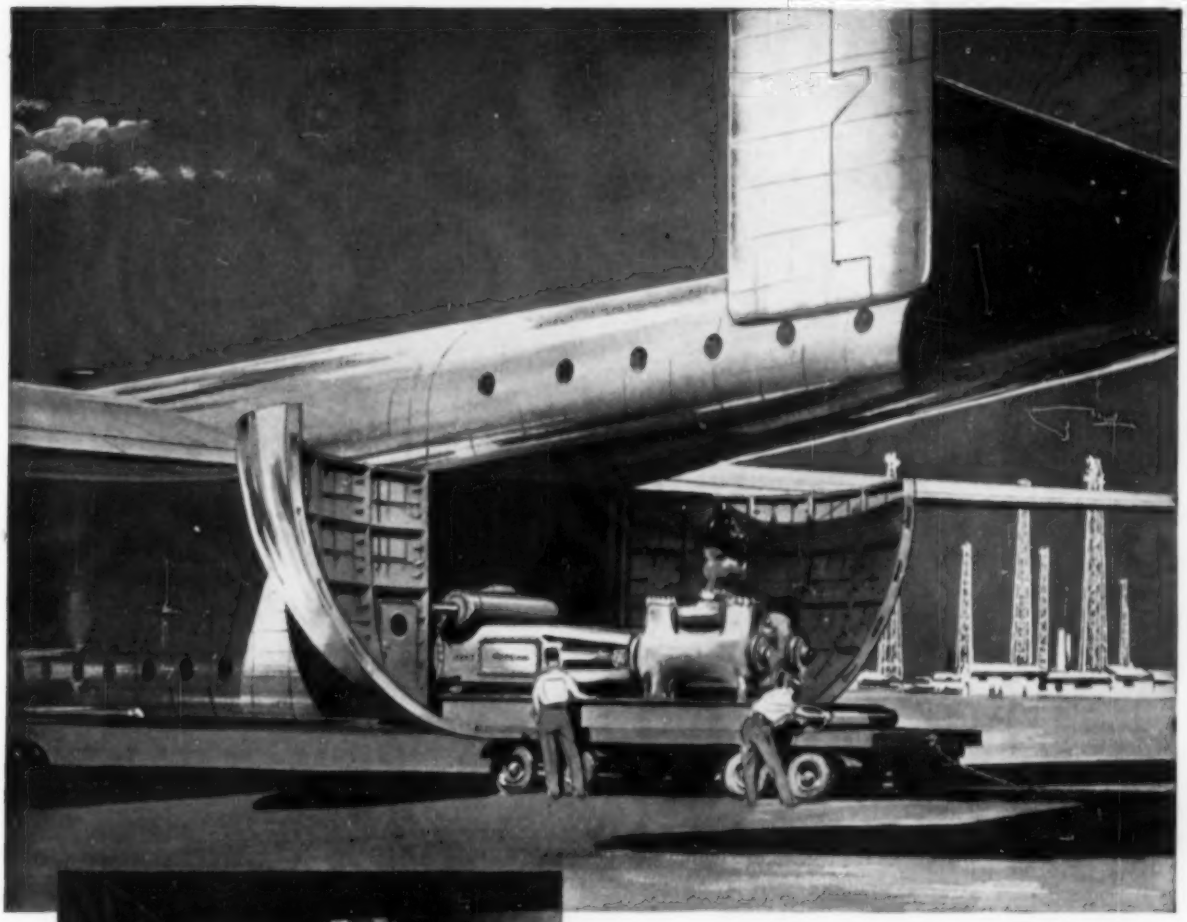

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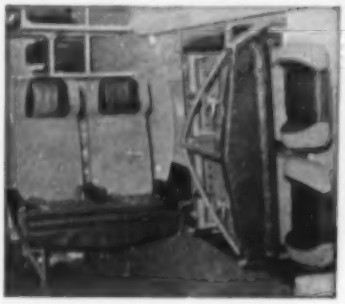

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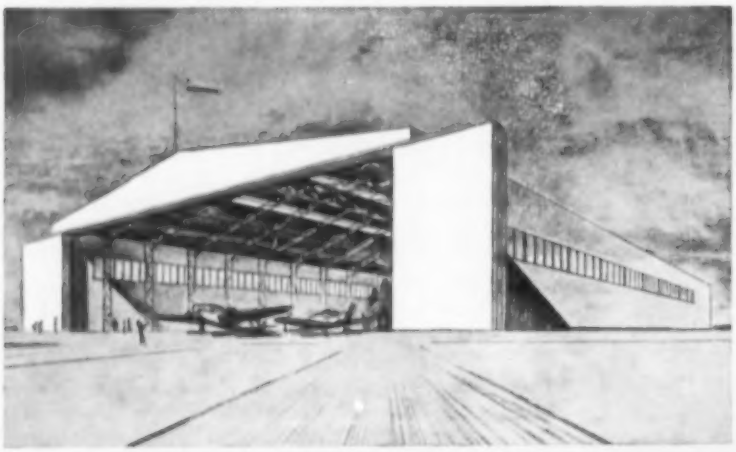

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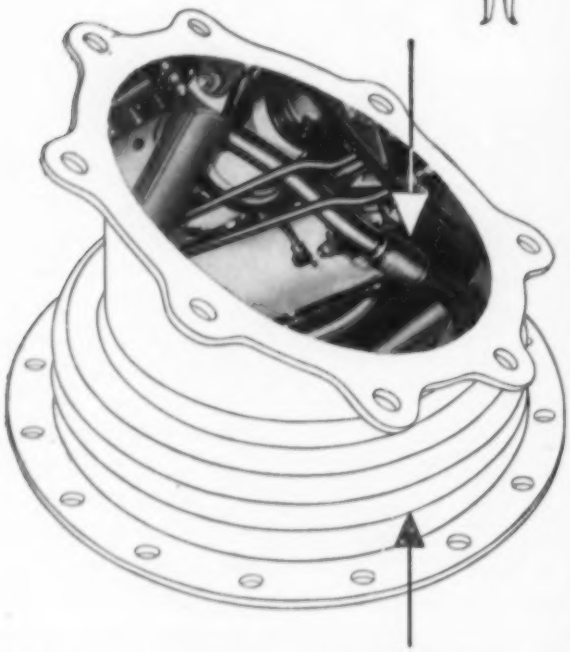

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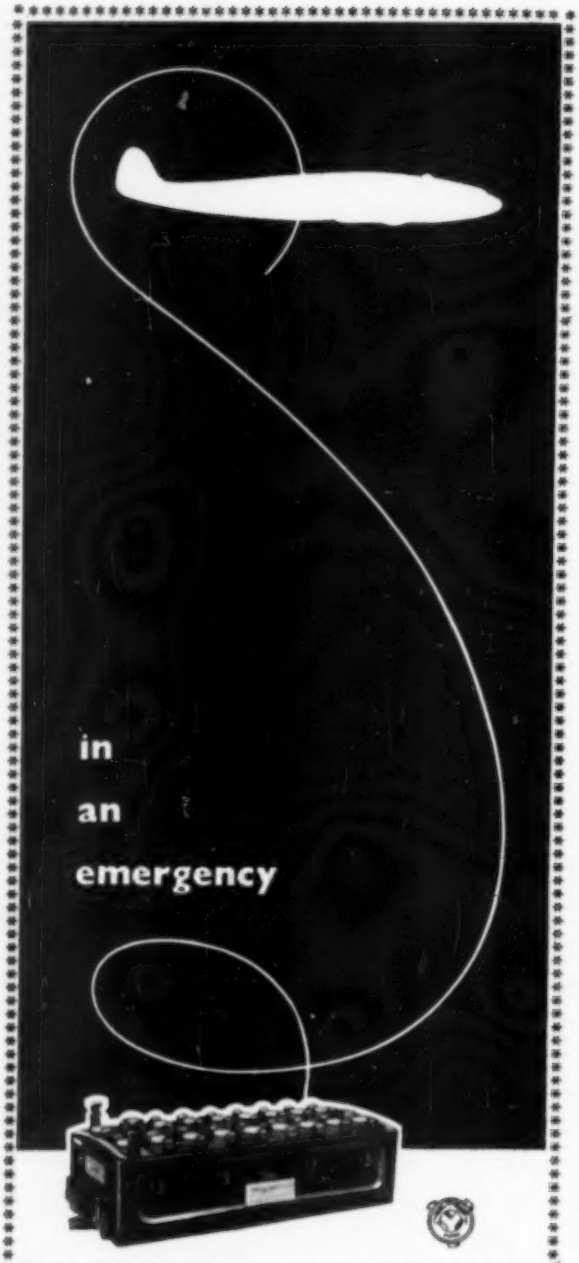

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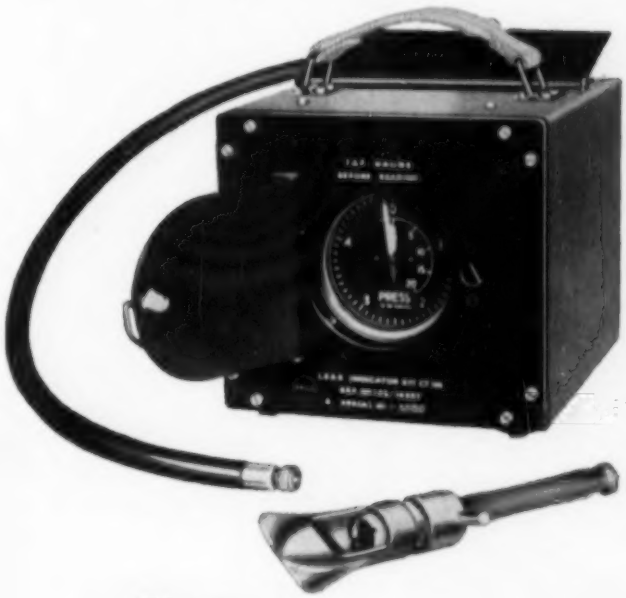

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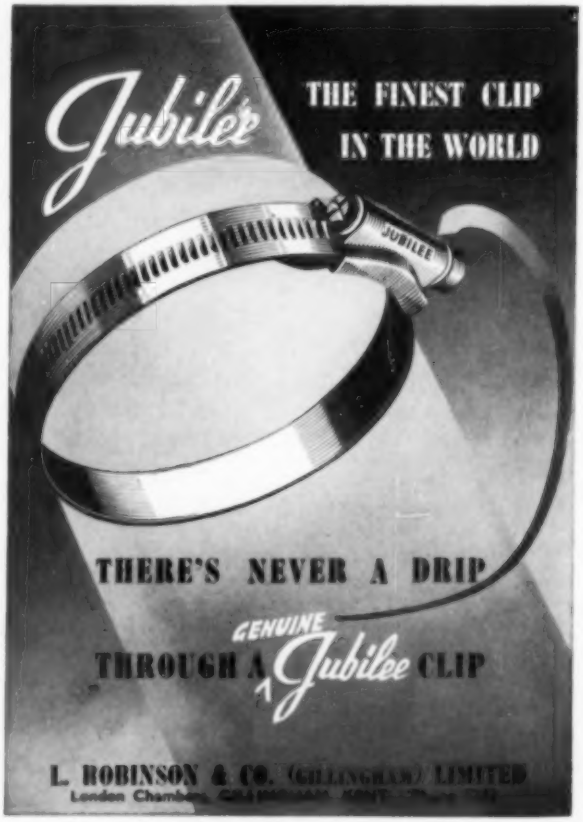

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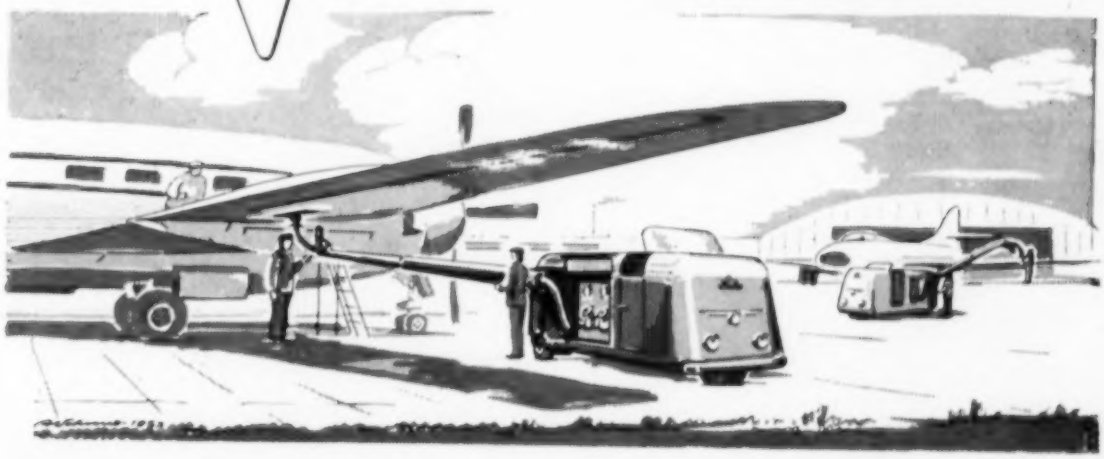

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Founded 1909

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Why Are We Waiting?

GENERALLY speaking we have the greatest admiration for the way in which airlines "process" their passengers. By comparison with almost any other form of transport, aviation offers clean, comfortable, sophisticated travel. In spite of the price paid for a ticket, there is the feeling that one is enjoying a privilege, as well as an experience, each time one takes a passage in a modern airliner. Even the hardy perennials among passenger complaints—the waiting period before and after a flight and the time of travel to and from an airport—are relative matters. Is an extra hour really important after saving perhaps weeks by flying instead of sailing from South America or the East? (Remind us to think of this next time we personally suffer a delay!)

There is one subject, however, to which we have referred on more than one occasion in the past, one which to our certain knowledge continues to frustrate and irritate air passengers, namely, the withholding of explanations for delays. The railways are, of course, worse offenders; they are more frequently late and probably do not know why themselves. The shipping companies, on the other hand, are usually quite good on this score. Why must the airlines—B.E.A. and B.O.A.C. among them—fail to tell their passengers the reasons for delays when they occur? Admittedly the traveller is sometimes informed, perhaps 30 minutes after the scheduled time of take-off, that the flight *will* be delayed by so many minutes, and on special occasions technical reasons or the weather may be mentioned. This is better than nothing, but we maintain that it is not unnatural for passengers to ask why, and to expect to be answered, immediately their carefully laid plans start to be upset.

Quite possibly the lack of ready information is simply the result of there being no one available to discover, quickly, the cause of the delay and to announce the findings to the passengers. If this is in fact the case, we would venture to suggest that the matter is of sufficient importance to passenger/operator relations to justify an additional member of the staff. To keep passengers in the dark is bad psychology. It disturbs everyone, it gives rise to alarm and it is in the nature of an insult to their intelligence.

Power at Paris

THE twenty-first Paris Show, concluded last Sunday, was above all an affair of powerplants, not merely as static items, but as subjects of aerial demonstration. The week-end crowds were edified (and once or twice well-nigh stupefied) by rockets and ramjets, and they gazed hour after hour upon machines variously propelled by most other forms of prime mover, characterized by their roaring, howling, beating or whispering. It was seen how the blast of a jet can be tamed to propel aircraft in reverse; how gas turbines are already serving as practical powerplants for helicopters; and how even big piston-engined transports can benefit from the judicious application of auxiliary turbojets. And in the static show could be glimpsed, in the models of coleopters (as described at length in this issue), how powerplant and airframe may ultimately become indivisible. Indeed, the Leduc ramjet aircraft was tangible, working evidence of such a trend.

Of more immediate significance were light, simple turbojets for special purposes, notably our own Bristol Orpheus and aspiring French rivals of about half its thrust, intended for dual installations in tactical-support aircraft or light fighters. And in the Turboméca range were miniature gas turbines—several completely new—in wide variety. That the French do not build them as mere trinkets is proved by the success of practical, light jet trainers and executive aircraft designed round such units.

As for installations, the beautiful new Caravelle transport, with its flank-mounted Avons, was an eminent example of imaginative French approach—the realization of a formula long postulated, but never, until now, accomplished. That the engines are Avons is at once gratifying and a sign that France's own high-power turbojets are insufficiently developed as yet for commercial application. This situation may well be altered in the years ahead. Meanwhile, it is satisfying that a nation with a healthily growing aero-engine industry of her own should set such store by the Avon, Sapphire and Viper, and (who knows), by newer and less conventional powerplants from these shores.

FROM ALL QUARTERS

Visits by King Hussein

THE recent Royal Navy exercise, Operation "Shop Window" was attended last Monday by King Hussein of Jordan. He flew from Northolt to the Fleet Air Arm base at Lee-on-Solent, and from there went by helicopter to the aircraft carrier H.M.S. *Centaur* in the Channel. King Hussein watched demonstrations by Avengers and Sea Hawks, an "attack" by four fast patrol boats, and diving by a submarine.

Later in the day he visited the Folland works, arriving by helicopter. He was received by Mr. W. A. W. Petter, Folland managing director and chief engineer. King Hussein was shown the nearly completed Gnat prototype, spent some time in the mock-up department, and went through the main assembly shops before taking tea with Folland directors and executives.

Among Folland officials who were introduced were Mr. N. Egan, director and secretary, Mr. D. B. Smith, Mr. Petter's personal executive, S/L. E. A. Tennant, chief test pilot, Mr. D. Walker, experimental manager, Mr. E. W. Taylor, works manager, G/C. S. O. Tudor, senior liaison officer, and Mr. A. E. Lane, assistant secretary.

The royal party was accompanied by Rear-Admiral Durnford Slater and W/C. Dalgleish. During the visit S/L. "Dick" Whittington demonstrated the Midge.

At Geneva's Show

HAWKER Hunters, English Electric Canberras and a Hunting Percival Provost will be representing the R.A.F. at the international air display to take place at Cointrin Airport, Geneva, tomorrow and Sunday, June 25th and 26th, under the auspices of the Swiss Aero Club and Swiss Air Force Association. The Hunters—a team of four and an individual machine—will be from No. 54 Squadron, stationed at R.A.F. Odiham; the four Canberras from No. 35 Squadron, R.A.F. Marham; and the Provost from No. 6 F.T.S. Ternhill. The Hunters and the Canberras were to be seen by King Hussein of Jordan when he visited R.A.F. Station Biggin Hill last Tuesday. Other countries to be represented at Geneva will be Canada, France, Germany, Italy, Spain, Sweden, Switzerland and America. The U.S.A.F. will be represented by the Skyblazers, on their North American F-86F Sabres.

Geneva radio reported last week that the organizers of the show have received a letter from the Soviet Union saying that the U.S.S.R. will take part, but, owing to shortness of time, will not be able to exhibit any of the early Russian aircraft in the "fifty years of aviation" section being staged in Geneva from June 24th to July 17th.

George Edwards to Vickers Board

IT is announced that Mr. G. R. Edwards, C.B.E., B.Sc., F.R.Ae.S., A.M.I.Struct.E., has joined the Board of Vickers, Ltd. Mr. Edwards is managing director of the Aircraft Division of Vickers-Armstrongs, Ltd., which will be taken over by Vickers-Armstrongs (Aircraft) Ltd., on July 1st, 1955, under the reorganization plan announced early this year. Take-over of the three subsidiary companies, covering aircraft, engineering and shipbuilding, will be back-dated to January 1st, 1955, but their directorships are effective from July 1st. In the case of Vickers-Armstrongs (Aircraft), Ltd., the directors are: Maj-Gen. C. A. L. Dunphie (chairman) and Messrs. G. R. Edwards (managing), J. Anderson, T. Gammon, E. J. Waddington and R. P. H. Yapp.

Before being appointed to his present position, Mr. Edwards was, as chief designer, the head of the team responsible for the Viking, Valetta, Varsity, Viscount and Valiant aircraft. His last design before leaving the chief designer's chair was that of the Vickers 1000 four-jet transport, already ordered for the R.A.F., the prototype of which is now under construction. Mr. Edwards, who is 46, is a B.Sc. of London University; he joined Vickers-Armstrongs at Weybridge in 1935, when he was 27.

TOPIC VISCOUNT?: Was the recent K.L.M. order the subject of Prince Bernhard's conversation on the Vickers-Armstrongs' stand at Paris? On the Prince's left is M. Heurteux, President of the U.S.I.A., and on the right of the picture Jack Rasmussen.

J. F. Arnold

WE regret to record the death, in a flying accident at Luton, of Mr. Joseph Frederick Arnold, the well-known Hunting Percival test pilot. The accident took place on Friday last, June 17th, after Mr. Arnold and Major Mahdi Salih, of the Iraqi Air Force had taken off in a Jet Provost for a local flight from Luton. Both pilots were killed.

Born on December 22nd, 1910, Joe Arnold was a civil flying instructor prior to the 1939-45 war. During the war he served in the R.A.F. as a flying instructor and with Transport Command on the North Atlantic service. From 1945 to 1948 he was manager and C.F.I. of the Luton Flying Club, and manager of the Hunting Flying Club: in 1948 he became a test pilot with the Percival company. He had some 5,600 flying hours in his logbook.

Shell Buy Helicopters

THE third civil S-55 order to be received within a month by Westland Aircraft, Ltd., has been placed by the Royal Dutch Shell Group, who will use the helicopters to facilitate offshore oil-drilling operations in the Persian Gulf. The Shell order brings to 19 the total number of S-55s ordered for commercial use since production of the type began at Yeovil; other recent customers are Bahamas Helicopter, Ltd., and B.E.A.

Each of the Shell helicopters will be equipped to carry eight passengers and two crew, and will be fitted with floats for emergency alightings on the sea. The first is scheduled for delivery in August and the second in October. It is expected that long-range tanks will be fitted for the ferry flight to the base of operations at Doha.

The S-55s will be operated on Shell's behalf by Bristow Helicopters, Ltd., whose managing director recently returned from the Antarctic with a fleet of four similar helicopters after taking part in last season's whaling expedition. The Persian Gulf opera-

THREE OF TEN de Havilland Sea Devons which have been delivered in twos and threes to the Royal Navy over the past month or two are seen before departure from Broughton.

tions will entail the transportation of crews and supplies to and from shore bases and drilling rigs, which may be separated by up to 70 miles of sea.

The two S-55s bought recently by Bahamas Airways are to be used on an unusual contract operation in New Guinea for an associated company of Shell; their duty will be to transport a lightweight drilling rig broken down into 1,000 lb sections from the main camp to a drilling site 25 miles away. When this work is completed the Bahamas helicopters will move to British Borneo for an offshore drilling contract similar to that described above.

Eglinton's Air Day

AN air display was held at R.N.A.S. Eglinton, Northern Ireland, on June 18th, drawing a crowd of 4,564, a record for the station. The Gannet A.S.1s of Nos. 820 and 824 Squadrons and the T.2s of No. 727 Squadron, all stationed at Eglinton, took part in demonstrations. Three of their number were also away taking part in the Paris Air Show. There was a mass attack on a dummy ammunition dump defended by the Army firing break-up shot; and Sea Hawks of No. 807 Squadron from R.N.A.S. Brawdy gave a first-rate display of formation aerobatics. Comic relief was provided by an S-51 which got airborne with a suitably caparisoned bedstead.

Hollywood Flies High

MOST readers of *Flight* will have the opportunity of seeing Paramount's *Strategic Air Command*, which opened at the Plaza, Piccadilly, on June 17th and is to be generally released in August. The opportunity should not be lost, for the film contains some of the most striking aerial pictures ever recorded by a camera, still or otherwise. It also provides an impression of the most powerful weapon yet constructed by man—the global bomber arm of the United States Air Force.

Lavish U.S.A.F. co-operation was extended to the makers of this picture, that it might explain accurately the purpose of the financial and human sacrifices required to make S.A.C. strong enough to prevent war or, at worst, to win it. To this extent the film is propaganda, and more sophisticated audiences may find parts of it too laboured for their liking. Thus, the story of S.A.C. is, for mass-audience appeal, pegged on to a husband-wife relationship—though, fortunately, one with fewer embarrassing moments than is normal in Hollywood renderings of service life.

The young bride (June Allyson), for example, does not collapse hysterically when husband James Stewart is whisked off for 21 months of active duty at the critical moment of his very lucrative career as a baseball player. One is almost prepared to overlook the winsome audacity with which she invades the base and sets up home in married quarters, constantly telephoning news of her progress to the discomforted Stewart (now a Lt.-Col.) as he undergoes his "physical."

But the wifely onslaught on Frank Lovejoy (who, as "General Hawkes," is the film's interpretation of S.A.C.'s fabulous commander, Curtis LeMay) is too much to swallow—unless one accepts Miss Allyson as symbolizing the concentrated resentment of all S.A.C. mothers, wives and sweethearts.

Like so many real-life Americans recalled for long spells of post-war duty, Lt.-Col. James Stewart asks "Why me?—I did my share in the war." Told that S.A.C. needs mature commanders more than ever before, he resigns himself to the prospect of 21 months in uniform and is soon contentedly installed in the left-hand seat of a B-36. Through the courtesy of S.A.C., Paramount, Technicolor and Vistavision, we are permitted to join the crews of the goliath bombers, which, like silvery prehistoric monsters, dominate the first half of the picture. Stewart is then transferred to the swifter, smaller B-47, and the theme of defence through deterrence develops to the point that the call of duty—even in peacetime—is too strong for him to return to civilian life.

Both B-36 and B-47 are thoroughly and skilfully photographed—inside and out, on the ground and in the air. For technical interest, the interior views of the B-36 and the aerial meeting of a B-47 and its KC-97 tanker are outstanding; perhaps the most dramatic sequence is the rearward view of a B-47's take-off, the fast-diminishing runway curtained by streaming plumes of rocket smoke; and the grandstand views of S.A.C.'s bombers at altitude are of breath-taking beauty. The most memorable scene, to our mind, showed a B-36 cruising at dusk above a slate-grey landscape in a lurid wake of contrail full of the departing sun.

NEW MARKINGS for this Grumman S2F-1 submarine hunter/killer are those of the Royal Canadian Navy. A specimen machine, supplied from America, it is the forerunner of CS2F-1s to be built under licence by de Havilland Aircraft of Canada, Ltd.

The Viscount Certificated . . .

OFFICIAL United States certification of the Viscount was signified on June 13th when, at a ceremony in London, Civil Aeronautics Administration type certificates for the first of Capital Airlines Viscounts, its engines and its airscrews were presented to the manufacturers concerned. The presentations were made by Mr. Fred B. Lee, administrator of the C.A.A.

Mr. Lee was introduced by his British counterpart, Mr. R. E. Hardingham, chief executive of the Air Registration Board, who drew attention to the remarkable number of "firsts" to the Viscount's credit: it was the first turbine-powered aircraft to receive a British C. of A., the first such aircraft to carry passengers, and was now becoming the first British airliner certificated by the United States. Mr. Hardingham made it clear that the negotiations leading up to the certification had not always been

A-HUNTING THEY WILL GO: Seeking new laurels for the R.A.F. are these members of No. 54 Squadron due to fly at Geneva (see opposite page). Below is the aerobatic team—l. to r. standing, F/O. P. V. L. Hamilton, Capt. R. E. Immig, U.S.A.F., F/O. B. J. Noble; kneeling, F/O. C. J. Redhouse. On the right is the "individualist," F/L. P. J. Fry.

A MILESTONE in Anglo-American aeronautical relations was the presentation ceremony reported below of C.A.A. type certificates for the first Capitol Airlines Viscount, its Dart engines and its airscrews by Mr. F. B. Lee, administrator of the C.A.A. Left-hand scene from the ceremony shows Lord Knollys (right) receiving the aircraft certificate on behalf of Vickers; seated are (left to right) Sir John Evetts, Mr. R. E. Hardingham (partly hidden) and Sir Colin Weedon. (Right) After the ceremony Mr. Lee (left) was presented with a model Viscount by Mr. Hardingham.

FROM ALL QUARTERS . . .

easy, but he paid tribute to the thoroughness and competence of the C.A.A. team of surveyors and pilots.

Explaining in a nutshell the meaning of the C.A.A. type certificate, Mr. Lee said that "this insignificant piece of paper" represented approval of specification, structure and performance, and conferred on the manufacturer concerned the right to enter the market of U.S. registration. It was his belief that the interchange of ideas between the C.A.A. and the A.R.B., with whom he had enjoyed working, had advanced the cause of safety. He then presented the three historic "pieces of paper"—airscrew type certificate 890, engine type certificate 283 and aircraft type certificate 814. These were accepted on behalf of the makers of the Rotol airscrew, the Rolls-Royce Dart 506 and the Viscount 744 by, respectively, Lt. General Sir John Evetts, managing director of Rotol, Ltd.; Air Marshal Sir Colin Weedon, export sales manager of Rolls-Royce, Ltd.; and Viscount Knollys, deputy chairman of Vickers, Ltd.

. . . and More Viscount Customers

FIVE new Viscount contracts have been announced by Vickers-Armstrongs over the last few days, bringing the total number of aircraft sold to 227. The new customers are B.O.A.C., K.L.M., Howard Hughes Tool Company and Standard Oil Company of California, and Fred Olsen Airtransport have placed a repeat order. Full details of the new contracts are given on page 884.

Rolls-Royce Turbojet Silencing

AMONG the firms who, at the request of the Ministry of Supply, have been conducting research into the problems of jet noise is Rolls-Royce, Ltd. Last week they disclosed interim results of their work and released a photograph—reproduced here—of a corrugated nozzle which has given encouraging results.

Introducing a note on the subject with the forceful reminder than an engine of 10,000 lb thrust generates about 100 h.p. in noise energy, Rolls-Royce say that the corrugated-nozzle system was arrived at after early experiments that met with only limited success. (An essential requirement is that any such device must not only effect a useful noise-reduction, but must do so without detriment to engine performance.)

A range of nozzles with different numbers of corrugations from sixty to four was made and tested. The results were most encouraging; the jet noise was reduced and, carefully designed, the nozzles did not affect the engine performance. The pitch of the noise affected by the corrugations was found to depend upon the number of corrugations, and a nozzle with six corrugations caused the largest reduction in the loudest band of the jet noise.

The latest nozzle to be tested, say Rolls-Royce, gives a noise reduction of 11-12 decibels, which means a reduction to less than half and corresponds to the difference in noise heard on the ground between an aircraft flying overhead at 1,000ft and one flying at about 3,000ft. Development work is continuing, and when the optimum point is reached production will be arranged and engines fitted with these nozzles made available.

All this work has been done on a specially designed test-bed, but a set of nozzles has now been made for the de Havilland Comet and will be flight tested in the near future.

Corrugated nozzles, it is stated, can be supplied with similar success to the Conway by-pass engine, which, even with a nozzle of the normal kind is much quieter than conventional turbojets.

Corrugated-nozzle jet silencer by Rolls-Royce.

Power for the DC-8

FOLLOWING the announcement, last week, that Douglas Aircraft had decided that the time was ripe to go ahead with their DC-8, news has been received that Mr. Nat Paschall and Mr. Ivar Shogram, respectively vice president for commercial sales and chief project engineer for the DC-8, were to arrive in London last Wednesday for visits and discussions about the new jet airliner. Apparently Mr. Shogram, who was previously Douglas powerplant group chief, has indicated his special interest in the Rolls-Royce Conway.

According to the Douglas release about the visit of the company's two executives "original announcements of the DC-8 said it would be powered by four Pratt and Whitney J-57 turbojet engines. . . ." The pointed re-quotation of this paragraph may or may not be intended as an official broad hint about Douglas powerplant thinking.

The DC-8 at the quoted 257,000 lb. a.u.w.

PARIS AERO SHOW ARRIVAL: The Bristol 173, flown by C. T. D. Hosegood, landing at Le Bourget airport exactly two hours after leaving the South Bank site in London.

TO U.S. ARMY ORDER. The McDonnel XV-1 Convertiplane embodies most of the features of both fixed- and rotating-wing designs. Recently it effected its first transition from helicopter to fixed wing flight and back again. Note the pusher propeller, here stationary, and the conventional flying-control surfaces used in forward flight. The single engine, a Continental R-975-19 giving some 550 h.p., drives both propeller and air compressor for the rotor tip jets.

is probably a little heavier than the Vickers 1,000, which is also to have four Conways. The thrust figure for these units is, however, greater now than when selected by Vickers and probably exceeds 12,000 lb. The Vickers 1,000 is designed for a cruising speed of more than the DC-8's 550 m.p.h.

There was some question, not long ago, as to whether the latest British turbojets could be made available to American aircraft manufacturers. There is little doubt that Rolls-Royce would be prepared to supply Conways, although they might well be reluctant to sell manufacturing rights for these new by-pass turbojets.

"Lamps" to Retire

Capt. A. G. Lamplugh.

AT a luncheon held after the annual general meeting of the British Aviation Insurance Company, Ltd., Sir John Makins, chairman, announced the retirement in September of Capt. A. G. Lamplugh, C.B.E., F.R.Ae.S., M.I.Ae.S., M.C.A.I., F.R.G.S., from his duties with the company as underwriter and principal surveyor.

This retirement, the need for which has been brought on by recent ill-health, does not mean, however, that his exceptional experience and ability will be lost to B.A.I.C., for he is joining the board of the company and will continue to act in an advisory capacity.

To "Lamps"—as he is known by his very many friends the world over—will go every good wish for a speedy return to full health and a happy retirement.

Rocket Specialist for A.W.A.

A LEADING specialist in rocket-motor engineering and a former senior executive at Woomera, Mr. Charles Bayly, is joining the armament division of Sir W. G. Armstrong Whitworth Aircraft, Ltd. His post has not yet been defined but will be "a very senior position."

Mr. Bayly was one of the original team sent out to Australia in February 1947 to set up the Long Range Weapons Establishment and Woomera Range. He served with the Ministry of Supply in Australia for four years, and was responsible for planning all range facilities of a technical nature, and later formed and ran the Test Vehicles Group responsible for assembly, testing and flight trials of guided weapons.

In 1951, he was appointed Rocket Motor Design Manager with I.C.I. at Summerfield Research Station, where he was responsible for the design, development and manufacture.

Mr. Bayly learned to fly with the R.A.F. Reserve at Air Service Training, Hamble, in 1935, and was with Armstrong Whitworth (assistant to production manager, Whitley V production) before joining the R.A.F. in 1940. After service with squadrons in the Technical Branch, he became O.C. Servicing Wing H.Q., Fighter Command. He joined the Ministry of Supply Armament Design Department immediately after the war, and was engaged on the early design of mono-fuel and bi-fuel rocket motors.

Hawker Siddeley Bid for CanCar

A REPORT that Canadian Car and Foundry, Ltd., of Montreal, had accepted an offer by the Hawker Siddeley Group (made through A. V. Roe Canada, Ltd.) to buy the shares of their company was confirmed in London last week. The CanCar Board is recommending shareholders to accept the offer.

Canadian Car and Foundry, Ltd., well known makers of railway equipment and commercial vehicles, established an aircraft division in 1937. After large-scale war-time production of Hurricanes, Curtiss Helldivers and other aircraft, they undertook, in later years, the building of Harvards under licence from North American Aviation; they were, in fact, granted exclusive manufacturing rights outside America. Their most recent products have included T-34s and components for Grumman S2Fs.

Sir Roy Dobson, chairman of the board of A. V. Roe Canada, Ltd., and a director of the Hawker Siddeley Group, was in Canada when the offer was announced. He said it would be recognized that "the technical skills of both companies would make for strong integration." In London, Sir Frank Spriggs commented: "Quite obviously we have great faith in Canada and Canada's exciting industrial future."

Reports from Canada have indicated that the total sum involved will be around $22,224,000 (about £8m). This would more than double the Hawker Siddeley Group's investment in Canadian industry.

C.A.I. Officers Elected

THE Canadian Aeronautical Institute has announced the election of its officers and council for 1955-56. The names and occupations of those chosen are as follows:—

President.—R. D. Richmond, chief development engineer, Canadair, Ltd.

Past-President.—Dr. J. J. Green, Chief of Division B, Defence Research Board.

Vice-President.—T. E. Stephenson, director, Aircraft Branch, Department of Defence Production.

Councillors.—J. C. Floyd, vice-president, engineering, Avro Aircraft, Ltd.; W. D. Hunter, technical director, de Havilland Aircraft of Canada, Ltd.; C. J. Luby, president, Canadian Steel Improvement, Ltd.; E. B. Schaefer, assistant chief engineer, Canadair, Ltd.; T. W. Siers, assistant to director of maintenance and engineering, Canadian Pacific Air Lines; J. Bertalino, inspector, Department of Transport; D. A. Newey, contracts administrator, MacDonald Brothers Aircraft, Ltd.; R. C. Guest, district superintendent, Department of Transport.

In addition, at the annual general meeting of the Institute held in Toronto on May 19th-20th, five Honorary Fellowships were awarded to the following: Rt. Hon C. D. Howe, Minister of Trade and Commerce; A.V-M. E. W. Stedman, R.C.A.F. (Retd.); Capt. S. Paul Johnston, director, Institute of the Aeronautical Sciences; R. R. Dexter, secretary, Institute of Aeronautical Sciences; Dr. A. M. Ballantyne, secretary, The Royal Aeronautical Society.

Australian Supply Minister Here

Mr. Beale.

THE Australian Minister for Supply, Mr. Howard Beale, Q.C., M.P., arrived at London Airport last week on a visit to the United Kingdom. He is investigating new developments in guided weapons and atomic energy, and will hold important discussions on these matters with Government representatives.

In his Ministerial post, Mr. Beale is responsible for the Weapons Research Establishment and the joint British-Australian Guided Missiles project at Woomera; the permanent atomic weapons testing ground; all defence science laboratories; and other Australian defence and supply departments.

Following his visit, which ends on July 19th, Mr. Beale will go to Canada and the U.S.A.

ALL MOD. CON.: A six-storey air-conditioned hotel is among features of the new $15m (£5m) airport at San Juan, Puerto Rico. Shown here is the terminal area as it appeared during the recent three-day opening ceremony, which was attended by 250,000 people. The airport has a single runway of 7,800ft.

HERE AND THERE

Viscount to Royal Launching

PROMINENT guests at the launching of of the Canadian Pacific liner *Empress of Britain* were scheduled to travel to and from the ceremony in a Viscount of Hunting-Clan Air Transport. H.M. the Queen, accompanied by H.R.H. the Duke of Edinburgh, was to perform the launching ceremony in Glasgow at 3 p.m. on Wednesday. Hunting-Clan took delivery of the second of their five Viscounts last week.

K.L.M. to Explore

THE air survey department of K.L.M. is to begin to map out the Merauke area in Netherlands New Guinea, in preparation for an irrigation project. After this work has been completed the next move will be a survey of the extensive Lake Plain, which is still an empty space on maps.

American Appointment

AT one time chief engineer of the San Diego division of Convair, Mr. Frank W. Fink has joined the Ryan Aeronautical Company as vice-president and chief engineer.

Down to Earth

THE American correspondent of our associate journal *The Autocar* reports that Chrysler have announced complete seat-belt installations as additional equipment on their current car models. The belts are said to meet functional specifications quoted by the C.A.A for commercial airliners.

Coventry Victor Flight Trials

FROM Southend comes news that the 55 h.p. Coventry Victor Flat-four, installed experimentally in a Piper Cub, is performing well. Some 35 hours of a 50-hour schedule have been completed; fuel consumption is about 2.4 gal/hr; throttle response is good. G/C. E. L. Mole with H. Best Devereux and B.K.S. Engineering Ltd. are responsible for the experiment. The engine weighs 220 lb and is in production for industrial users. It is hoped to get clearance for the ultra-light installation —the Turbi is in mind.

Norwegian-Swiss Aluminium

THE Norwegian firm Elektrokemisk, Ltd., and the Swiss Aluminium Co., Ltd., plan to establish an aluminium factory, with a production—to begin in 1958 —amounting to some 20,000 tons a year, in the Northern region of Norway.

Woman Pilot's Australia Flight

THE first woman pilot to fly a single-engine aircraft from England to Australia for many years arrived last week at Darwin airport. She is Mrs. Nancy Leebold, who flew a Miles Messenger with her husband as navigator. Mrs. Leebold is said to have some 2,500 hours on her log-book, mainly accumulated as a pilot of freighters in Australia early in the war. Her husband was an R.A.F. air gunner.

Getting the News Through

WE trust that all *Flight* subscribers received their copies safely during the period of the railway strike; every possible effort was made by the publishers, in the face of the postal restrictions imposed, to make sure that they did so. Incidentally, in the early stages of the strike the Newspaper Proprietors' Association was spending approximately £2,000 a day in flying papers from London. This figure—which excludes air charter fees to Scotland and the cost of flying papers from Manchester —was later increased to £2,500.

R.A.F Benevolent Fund News

SUBSCRIBED for by American Air Force officers attached to R.A.F. units in Britain, a new artificial-grass cricket pitch has been given to the boys of Vanbrugh Castle, the R.A.F. Benevolent Fund's residential school at Maze Hill, Blackheath. General J. M. Sterling, U.S. Air Attaché in London, inspected the new pitch on Thursday of last week.

Contributions to the Fund from the R.A.F. Officer Pilots' Tie Club now amount to £500. This sum represents a levee of one shilling on every tie, together with the club's profit. G/C. G. A. R. Muschamp is hon. secretary of the club, which was formed in 1937.

R.A.A.F. Sabre Armament

AUSTRALIAN-BUILT Sabres, according to a Sydney report last week, "will be equipped with guided missiles as their primary offensive weapons."

More Flying-Doctor Bases

THE Royal Flying Doctor Service, which now covers nine-tenths of Australia, is being further developed by the setting-up of new bases at Carnarvon and Derby in Western Australia and at Miles in Queensland. New bases are also planned for Papua and New Guinea. The ultimate aim is to provide for day and night landings.

Grand Tour

ON Tuesday last the Bristol Sycamore demonstrated at Le Bourget was due to leave for Stuttgart, where it was to appear at a three-day helicopter convention. Next Sunday, June 26th, it will be flown by test pilot Peter Moore from Stuttgart to Innsbruck, where it will give a series of alpine rescue demonstrations.

U.S.S.R.'s Big Twin

A LENINGRAD broadcast last week, dealing with the development of aviation in the U.S.S.R., mentioned that "the giant twin-rotor helicopter," seen over the city recently, is capable of lifting "a detachment of 40 troops, fully equipped." No further information about the machine was given.

H.P. Directors

LEGAL Advisor to Handley Page, Ltd., since 1921, Mr. F. S. Gaylor has resigned his directorship of the company, dating from 1948, but will continue to offer his services in an advisory capacity.

Last week the announcement was made that Sir Thomas Stuart Overy has been appointed a director of Handley Page, Ltd. —also in a legal capacity.

For Photographers

AMATEUR PHOTOGRAPHER, one of our associate journals, is publishing on June 29th a special guide containing a complete buying reference to all cameras on the British market. Included are details of price, lens, shutter and other equipment, country of origin, and name of manufacturer or importer.

Copies of the issue, price 1s as usual, can be obtained from all newsagents, or direct from Dorset House, Stamford Street, London, S.E.1.

Gold Braid Needed

UNIFORMS designed for Lufthansa (the revived German airline) were intended to be distinctive by their lack of gold braid, polished buttons and unnecessary badges. But it was found that these unobtrusive uniforms had quite the wrong effect on the public, who—it is said—like to be impressed, and given confidence, by a multiplicity of gold rings on a captain's sleeve. Lufthansa captains now sport rings at least as wide as those of rival companies.

Industry v. Airlines at Golf

IN a recent competition at Wimbledon Park Golf Club, the Aircraft Golfing Society (members of the aircraft industry) defeated the Foreign Airlines Golfing Society by seven matches to six. Playing in great form for the A.G.S. team (captained by Mr. B. Songhurst) was Mr. M. MacCready: his round of 64 is understood to be a record for the course. At a dinner following the day's play, the Foreign Airlines G.S. secretary, Mr. W. Whelan, presented a cup to the winners. Captain of the defeated team was Mr. N. Croucher.

ROLLS-ROYCE

AERO ENGINES LEAD THE WORLD

The United States of America
buy Rolls-Royce
propeller turbine aero engines.

Le "Mystère IV."N Dassault utilise les alliages Nimonic*

Ce nouvel intercepteur tous temps Dassault est équipé d'un moteur Rolls-Royce Avon RA.7R à post-combustion, dans lequel le Nimonic 90 est utilisé pour les ailettes du rotor. Perfectionnement de l'intercepteur de jour Mystère à siège unique et ailes en flèche, le IV.N a un fuselage plus long et peut prendre un passager derrière le pilote. Il est muni d'un système de commande de feu par radar du type avancé et, en plus de ses deux canons de 30mm montés dans le fuselage, il porte un chargement formidable de rockets. La poussée conjuguée du moteur Avon et de la post-combustion donne au IV.N une vitesse ascensionelle élevée et sa capacité impressionnante de 5000 litres de combustible permet une durée maximum de vol de 5 heures. Le groupe propulseur dans les modèles futurs sera constitué par un moteur Avon encore plus puissant. Il sera construit sous licence par Hispano-Suiza et les alliages Nimonic résistants à chaud y seront à nouveau employés.

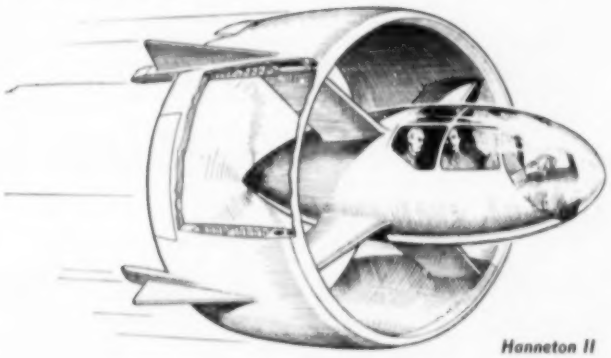
In French, as in any language, the name Nimonic means good resistance to high-temperature oxidation, creep and fatigue. The Nimonic series of heat resisting alloys is used for the turbine rotor blades of every British aircraft gas turbine, and will also be employed in the Rolls-Royce Avon which is to be built under contract by Hispano-Suiza for later production models of the Mystère IV.N.

**Nimonic is a registered Trade Mark.*

HENRY WIGGIN & COMPANY LIMITED · WIGGIN STREET · BIRMINGHAM 16

WITHOUT VISIBLE MEANS of SUPPORT

Ultra-Modern French Entomology — the Coleopter



Hanneton II

THE curious "coleopter" is one of the first types of vehicle in which both structure and powerplant are integrated. In some respects these aircraft resemble the "flying barrel" machines of the 1920-1930 era, in which a propulsive airscrew was mounted inside an annular duct; but, unlike these, the coleopter employs the annular duct as the sole generator of lift in cruising flight. A comparison could also be drawn with the recent American Hiller ducted-fan helicopter; but the latter maintains its major axis sensibly perpendicular. Most of the interest in coleopters centres upon the French Bureau Technique Zborowski, and in these pages a well-known aeronautical engineer outlines their work.

By A. R. WEYL, A.F.R.Ae.S.*

WINGLESS aeroplanes with retractable fuselages and "suffused" powerplants would form lovely playgrounds for the gadget maniacs, who could hang their baubles on them and/or bury colossal electronic edifices within them. Closely approaching this dream of the frustrated aircraft designer comes the coleopter.

Coléoptère means "beetle"; but at first sight, this aerial vehicle looks rather more like the Martian stage-coach of a "night-starvated" science-fiction writer, or perhaps like an animated wind-sock.

Yet this airborne propulsive duct is an aeroplane indeed, and actually the product of sound design-philosophy for which highly qualified aeronautical engineers claim responsibility; at present the French Government handles part of the development, and an entire entomological family of military and civil projects following the basic conception is under active development (see table, p. 862).

The basic idea underlying the coleopter is to utilize the lift of an annular (ring-shaped) wing which houses and guides the propulsive jet (i.e., airscrew or thermal gas-jet, as the case may be). But before we deal with the engineering aspect of this radical approach, something should be said about the people behind it, all German technicians settled in France, each with 20 to 30 years of practice in aeronautical engineering research.

Inventor and head of the B.T.Z. (Bureau Technique Zborowski, Brunoy, France) is Dipl-Ing. H. v. Zborowski, formerly in charge of B.M.W. rocket development and responsible for the existence of the nitric acid/aniline motor (widely used in guided missiles). The aerodynamicist is Dr. W. Seibold, well known from work in German and French research establishments. The structural expert, Professor Dr-Ing. H. Hertel, has a world-wide reputation as former technical director of Heinkel as well as of Junkers; in these connections his name is associated with such notable designs as the first single- and twin-jet-engined aeroplanes (He 178 and He 280 respectively); the fastest pre-war rocket aeroplane (He 176); and the first multi-jet bomber (Ju 278). People like this are not propagandists of science-fiction; they are experimenters building upon sober facts.

B.T.Z. coleopter development began in 1950 and includes much wind-tunnel and model research. Since 1952, the Société Nationale d'Etude et de Construction des Moteurs d'Aviation (S.N.E.C.M.A.), directed by Professor Dr-Ing. H. Oestrich, has collaborated actively with B.T.Z. in experimentation and development. Last year, the French Air Minister was shown a free-flying controlled model.

In aircraft development, we are now passing out of the stage of fitting airframes with propulsion devices. The next and final stage will be the complete "melting together" of sustentation and propulsion into indivisible units. Known possibilities include the jet-propelled wing, the flapping wing, the paddle wing, and the tiltable and lifting rotor. We know, too, that jet lift can replace wing or rotor lift. None of these amalgamations, however, has as yet produced an entirely satisfactory solution.

The standard aeroplane renders sterling service for high-speed flying. The attainment of really high speed is, however, limited by the wing area needed for take-off and landing, and the speed range is restricted by the existence of a stalling speed. The latter, in turn, dominates the characteristics of take-off and landing, because the aeroplane has to be horizontally accelerated or decelerated up to or down from this minimum speed of sustentation. High-speed flying is, therefore (and whatever flap-fiddlers may say), unavoidably linked up with high stalling speeds.

The consequences of high stalling speeds are expressed in landscapes obliterated by huge aerodromes covered with miles of concrete runways; in elaborate undercarriages, flaps, air brakes, etc.; in undesirable circumstances and unpleasant incidents. All this was thoroughly appreciated and bewailed years ago, yet no serious attempts were made to curb the evil at the source. It took the advent of the helicopter to make people realize that suggestions for vertical ascent and landing were not preposterously absurd.

We possess powerplants light enough for the vertical elevation of practical aircraft and odd furniture, by direct jet lift. For an aeroplane with aerodynamically lifting wings this means that wing loading and wing shape are no longer dominated by the requirements of take-off, climb, and/or landing. A winged engine, however, need not be practical for military use because of conditions imposed by manœuvrability in turning flight. The stalling speed of a wing limits the diameter of the narrowest turn, and the aeroplane of standard configuration must bank. With guided missiles, therefore, cross-wing arrangements are preferred as soon as stress is laid upon turning manœuvrability.

The annular coleopter wing is characterized by an internal flow duct, thin aerofoil section and low aspect-ratio. In addition to aerodynamic lift, the propulsive jet produces a lifting component when at incidence (incidence in this case is referred to the direction of gravity, and for the purposes of this discussion, lift can be regarded as a force opposed to gravity). This jet lift may, according to the angle which the duct axis assumes against the direction of gravity, range from zero to a force equalling (or exceeding, for climb) the weight of the aeroplane. Consequently, the coleopter has a speed range which extends from maximum (or diving) speed right down to zero speed, vertically and horizontally. There is no limitation by a stalling speed.

When the aerodynamic incidence of the wing—against the direction of motion—approaches its critical value (separation of flow, with subsequent loss of aerodynamic lift), the loss of lift is compensated by jet lift, i.e., by the lifting component of the thrust.

The novelty of the coleopter conception is covered by numerous patents held exclusively by v. Zborowski. Arrangements to produce or guide a propulsive jet within a tubular duct have, however, often been proposed or tried; the ducted airscrew, for instance, actually goes back to G. Koch's aeroplane project of 1893, and a ducted-fan-propelled aeroplane was built by H. Coanda in 1911. Annular duct-like wing systems, though without a propulsive jet inside, were characteristic of Giraudan's tandem aeroplane of 1909.

Nearly all coleopter projects show a central body or fuselage centrally within the duct, extending from it in the forward direction. This fuselage houses the propulsive plant and the pilot (or automatic guidance). The pilot, and any passengers, are in seats that tilt for the transition from vertical to horizontal flight,

**The author states that he is obliged to the firm of B.T.Z.—in particular to Dipl-Ing. H. v. Zborowski and Dr. W. Seibold—and also to Professor Dr-Ing. H. Oestrich (of S.N.E.C.M.A.) for the technical information quoted and for the illustrations.*

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and *vice versa*; this adjustment is automatic. Fuel and accessories are buried within the structure of the ring-wing.

A prone pilot's position in level flying would seem ideal for the coleopter. The pilot would be standing upright during ascent and descent; this is perfectly natural, and the disadvantages of a prone position during take-off and landing manœuvres would be absent. Some B.T.Z. intercepter projects do in fact incorporate a prone pilot position.

The coleopter principle has been applied to a number of projects, which have been carefully elaborated. These projects range from substantial airscrew-driven passenger aircraft to piloted and/or guided turbojet-cum-ramjet operated intercepters, and to rocket-propelled anti-tank infantry missiles. The table on this page gives some data on manned and unmanned aircraft projects.

Aerodynamic Considerations. That bodies of rotation can produce lift when moving under an incidence to the direction of motion is known from airship practice; and that the shape need not be aerofoil-like in cross-section is also known from the earlier dirigibles. An internal duct within such a body, through which air can flow freely, deflects at incidence additional air downwards, and hence increases the lift. This gain is, however, diminished by any obstructions within the duct, such as a fuselage, struts, flame-holders, and so forth. A further decrease of flow is caused by ramjet combustion within the duct. A theoretical investigation of the lifting properties of an annular wing was made by Ribner in 1947, and wind-tunnel tests have confirmed his results. Also, the influence of lift losses due to the presence of a fuselage, etc., within the duct has been well established.

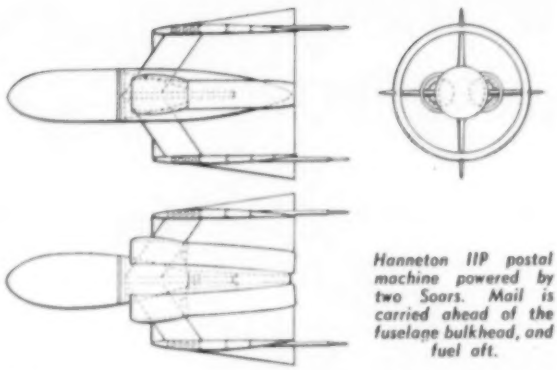
The aerodynamic properties of coleopter arrangements, including the centre-of-pressure position, were carefully checked by B.T.Z. in wind-tunnel investigations at St. Cyr and at Zurich; and, additionally, by O.N.E.R.A., for all speed ranges up to Mach 1.4; tests at still higher supersonic speeds are at present under way. Good agreement with the calculations used was found. The "mixed-flow" range, with supersonic velocity outside and subsonic velocity inside the duct, is still not amenable to calculations of centres of pressure.

Within the no-compressibility range and for the aspect ratios employed, a maximum lift coefficient of 1.3 (referred to the projected wing area, i.e., diameter times length of wing) may be assumed. Normally, annular-wing loadings are referred to the cross-sectional area of the wing. Within supersonic range, flight always takes place at incidences far below that of maximum lift; that value, therefore, does not matter.

The diameter required for the coleopter wing follows from the lift value needed for level flight at cruising speed. Knowledge of the cruising drag and of the thrust at disposal within this speed range is, therefore, essential.

The wind-tunnel investigations have exhibited no abnormalities in the aerodynamic behaviour of the coleopter. Earlier American experimentation at certain plane wing shapes of low aspect-ratio had indicated a non-linear dependence of lift and moment coefficient from the incidence. This is not confirmed for the annular wing. The conception of an aerodynamic centre can, therefore, be applied.

For flight at supersonic speeds, the coleopter may make use of Busemann's "supersonic biplane" arrangement for a reduction of the wave drag. That this is efficient for ring shapes has long been known from Swiss ballistic experimentation with hollow projectiles; and, independently, Sir Frank Whittle has referred to similar arrangements during his earlier work. On the other hand, the shock formation can, as proved by Oswatitsch for supersonic ram intakes, be usefully exploited for raising the compression within the duct, so as to improve the thermodynamic efficiency of thrust generation. The coleopter lends itself well to flight at high Mach numbers on account of the very thin wing, the low aspect-ratio, and the absence of major interferences.



Hanneton IIP postal machine powered by two Soars. Mail is carried ahead of the fuselage bulkhead, and fuel aft.

In subsonic drag, the annular wing proves inferior to plane wings having equal lift and the same aspect-ratio.

The greater wetted area of the annular wing gives rise, of course, to increased surface friction. Apart from this, more drag may arise from an increase of profile drag with incidence and because of accumulation of boundary-layer material on the dorsal side of the wing, caused by span-wise flow components. The provision of protruding rib-like boundary-layer fences has, therefore, been suggested by Richter. Because of higher drag, the L/D ratio of the annular wing is only 80 per cent of that of plane wings having the same aspect-ratio. Against equivalent cross-wing arrangements, the coleopter is, however, substantially better. This is of importance for guided-missile applications.

Since, in view of the jet-lifting properties, the stalling speed is relatively unimportant, it is, in the case of the coleopter, admissible to compare wing arrangements on the basis of equal span. If this is done, the annular wing scores over plane wings having the same span for up to about 17ft diameter and incidences exceeding 5 deg. This superiority of the annular wing is the more important, because it is achieved with a substantially lower wing-construction weight.

Aeromechanical Behaviour. Stability and control of the coleopter present problems of greater complexity. A ring wing, particularly one provided with a protruding fuselage, will most probably have no stability in pitch or yaw unless there is sufficient fin area aft of the centre of gravity. The coleopter has fins which extend over the rear part of the wing like boundary-layer fences (and act as such) and continue along to the rearwardly extending landing legs. These fin structures carry no control surfaces. The latter form part of the trailing edge of the annular wing, as curved flaps; these control flaps, therefore, also affect the flow through the duct.

Like a cross-wing arrangement, the annular wing requires no banking for turning flight; both arrangements are thus superior

B.T.Z. "COLEOPTER" PROJECTS

Type designation	Purpose	Powerplant	Weights		Diam. (=span)	Length	Cruising			Top speed	Ceiling	Climb to 50,000 ft	Military or payload
			Empty (lb)	Launching (lb)	(ft)	(ft)	Speed (m.p.h.)	Range (miles)	Alt. (ft)	(m.p.h.)	(ft)	(min.)	(lb)
Hanneton II ("Cockchafer")	Transport (4-seater)	Two Turboméca Marcadau II turboprops	1,780	3,760	11.8	19.7	280	620	16,500	340	—	—	—
Hanneton III-A	Transport (6-seater)	Two Turboméca Marcadau III turboprops	2,880	6,200	13.4	16.5	375	1,240	16,500	400	—	—	—
Hanneton IV	Transport (12-seater)	Armstrong-Siddeley Double Mamba turboprop	5,520	11,250	15.1	32.8	435	1,560	16,500	465	—	—	—
Hanneton IIP	Pilotless, guided mail carrier	Two Rolls-Royce Soar turbojets	1,150	2,780	11.8	16.5	620	620 1,240	33,000	620	—	—	885 440
Hanneton III-P		Two Turboméca Marcadau III turboprops	2,650	6,200	13.4	16.5	375	1,560 2,500	33,000	375	—	—	1,650 550
Charançon IV ("Weevil")	Piloted intercepter, single-seat fighter	S.N.E.C.M.A. Atar 101-G turbojet, and ramjet	4,650	7,950	8.5	28.5	1,300 +530	62 +78	36,000	1,300	>66,000	2	220
Charançon VI	Pilotless, guided intercepter fighter*	S.N.E.C.M.A. R.105 turbojet and ramjet (3,960 lb. st. thrust)	1,680	3,180	5.4	17.8	1,300 +530	78 +93	40,000	1,300	>66,000	2	220
Scarabée IV ("Scarab")	Piloted intercepter, single-seat fighter	Bristol BE.25 and ramjet	7,750	15,500	12.8	31.1	1,300 +400	62 +375	20,000	1,300	>66,000	2	1,100
Scarabée V	Piloted low-altitude and ground attack fighter (single-seater)	Bristol BE.25	7,300	15,500	12.8	31.1	375	930 1,150	S.L. to 20,000	465	—	—	1,650 550
Brucho A ("Seed Beetle")		S.N.E.C.M.A. Atar 101-G turbojet	4,230	7,950	8.5	28.5	375	310 465	S.L. 20,000	>680	—	—	1,650 550
Brucho B		S.N.E.C.M.A. Atar 101-G turbojet and ramjet	4,650	7,950	8.5	28.5	900 +375	15 +125	S.L. 20,000	900	—	—	550

* Recoverable guided-weapon carrier.

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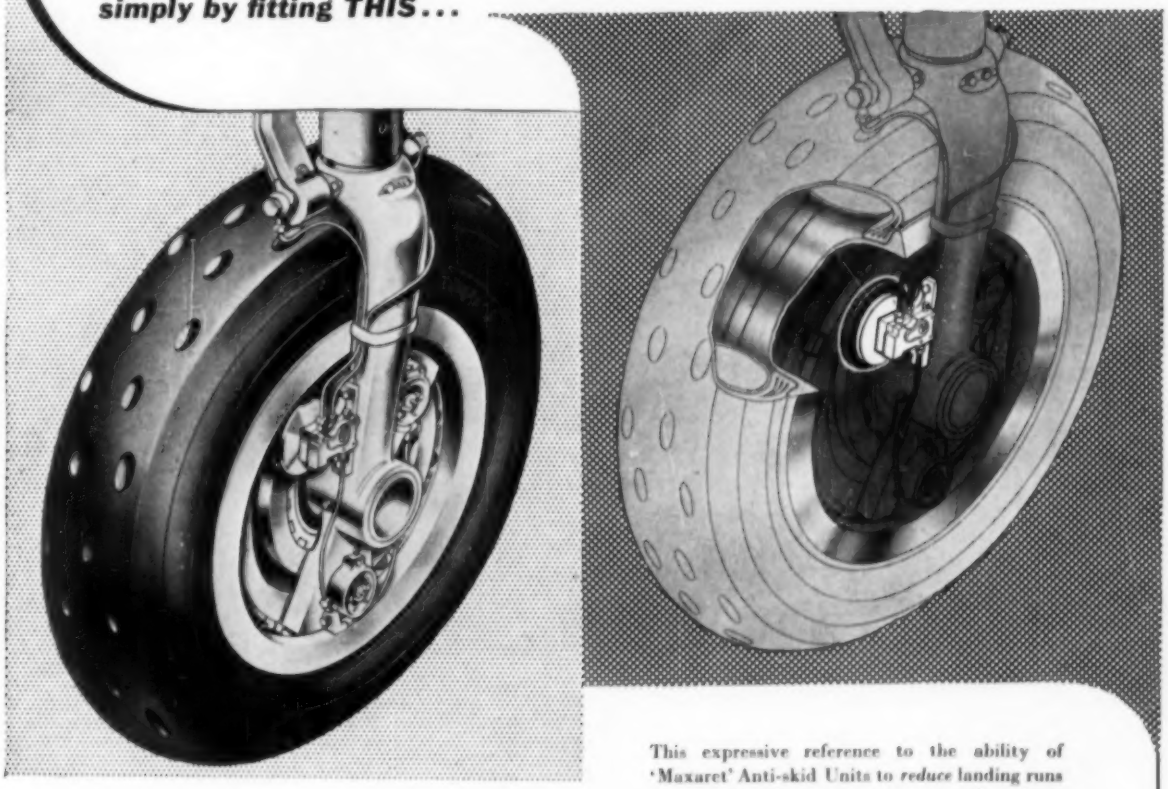

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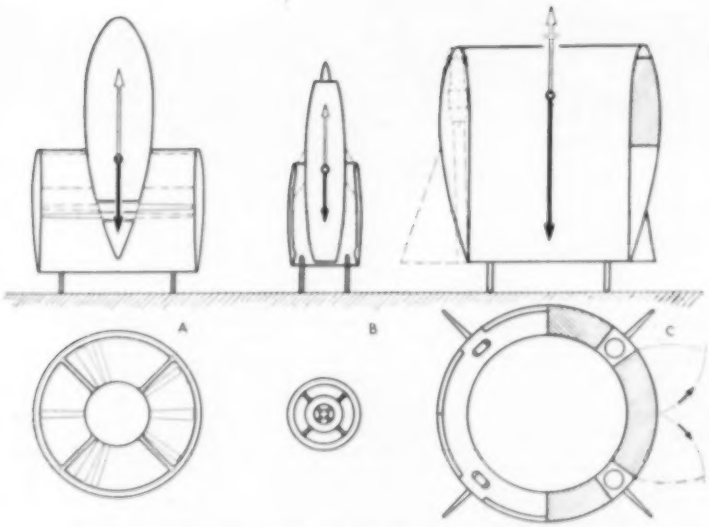

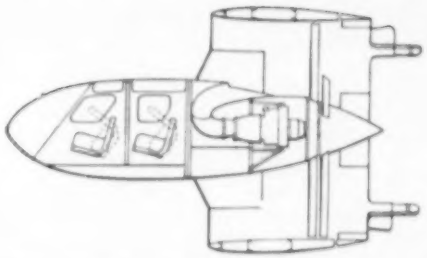

Honneton II liaison aircraft powered by a pair of Turboméca turboprops.

(Left) Three basic patterns of coleopter now being developed by the B.T.Z.: A, a subsonic design powered by a gas turbine driving contraprops; B, a supersonic turbojet/ramjet coleopter; C, a large flying wing driven by four buried turbojets.

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to the plane wing, as far as manœuvrability is concerned. In manned coleopters, handling in turns will be a queer sensation, partly because of the absence of banking and partly because of the immediate response.

In spite of the fins, the damping in roll will be small, and it will be non-existent at near zero speed. Thus a powerful lateral control is necessary to keep the coleopter from rolling under the influence of revolving turbines or jets, or because of lack of symmetry. Like all other coleopter controls, it must be effective regardless of speed or attitude of the aircraft. Actually a rotation of the aircraft about the duct axis need not affect the path of flight—given appropriate cyclic control changes similar to the control-reversal cycle employed with the German X-4 cross-wing missile—but being whirled about might be unpleasant for the pilot of a manned coleopter, and for sensitive equipment.

In view of the wide range of operational incidences, from 90 degrees (vertical flight) to very small incidences (diving), the quick damping of pitching oscillations demands special attention. Fortunately, the jet exhaust provides a high damping coefficient in pitching motion. The case of flight without power need not be considered.

The problems of control during take-off and landing are complex and form the subject of intense experimentation. Vertical flight demands full manœuvrability at zero forward speed (take-off) or when flying backwards (landing descent). At such speeds, the aerodynamic stability and the aerodynamic damping of disturbing motions become, of course, ineffective.

During descent, the coleopter moves aerodynamically backwards with respect to the air surrounding it. However, the jet which controls the speed of descent flows through the duct in the same direction as during ascent and forward flight. Thus control organs which are exposed to the jet do not reverse their action (as would be the case with purely aerodynamic control surfaces). This, of course, simplifies control.

The take-off resembles that of a free-launched rocket missile of the V.2 kind. An additional disturbance is, however, the reaction from rotating propulsive elements, such as turbine rotors or airscrews. As there is no initial velocity, the motion is exclusively determined by the strength and the direction of the jet efflux. As long as the line of action of the resulting thrust passes through the centre of gravity of the aircraft, a rectilinear motion results. Disturbances, however, demand adequate control facilities for damping and for correction of the ensuing path of flight.

V.2 rockets ascended under automatic control, steering by graphite vanes which were exposed to the efflux. Other large rockets were steered by means of direct movement of the jet-pipe. Evidence from the S.N.E.C.M.A. experimentation proves that the problems of coleopter control during launching and landing can be solved practically.

Close to the ground, and when standing on it, thermal-jet-propelled coleopters suffer from the same disability as other jet lifters—the impact of hot gases upon the ground. In coleopters, however, the effect is moderated by the airflow which is induced through the duct and which enshrouds the gas jet and mixes with it. V.2 rockets were fired from launching tables with flame deflectors. Ground protection during landing of coleopters may pose a problem, and ships' decks would need fireproof or cooled landing platforms.

Coleopters have four shock-absorbing landing legs. Each terminates in a structure which spreads under load so as to form a "foot" that will offer resistance to sinking into soft ground. For ascent, the aircraft, standing with its duct axis vertically, lifts off these legs and climbs to, say, 600ft before tilting over into position for level flight. During this tilting manœuvre, the coleopter is gaining height, since the thrust exceeds the weight, until a near-horizontal attitude of the duct axis is attained. This point having been reached, the forward speed has increased sufficiently to derive adequate aerodynamic lift from the wing. During this manœuvre, the coleopter is under complete control, regardless of attitude or speed, and even when the wing has higher incidence than that of stall.

Alternatively, the coleopter may continue in vertical or inclined climb, with the jet at full blast. In this manner, the manned single-seater intercepter might reach 50,000ft altitude within two minutes of launching, maximum supersonic speed being attained towards the end of this climb.

Operational Procedures. For satisfactory and safe climbing, the launching weight should not exceed 80 per cent of the static thrust. Boosting devices such as rockets, JATO, etc., are not needed (except for certain ground-weapon developments of B.T.Z., not included in this discussion). For transition to level flight, a vertical climbing speed of about 100 ft/sec (6,000 ft/min) is considered suitable. The relative speed of flight is steadily growing whilst transition is taking place, since more thrust is becoming available for acceleration with decreased demand for direct lifting.

For landing, two alternative manœuvres can be adopted. One is to reduce speed gradually by increase of incidence without gaining altitude, until all speed is lost; the coleopter then begins to sink with the nose high (low-aspect-ratio wings stall at high incidences, and the stall itself is not a dangerous attitude with this class of aircraft). This procedure requires a long approach at low altitude.

The other approach manœuvre relies upon a rapid change of the path of flight, by climbing steeply at reduced propulsion until the aircraft assumes a near-vertical position, with no forward speed. This renders it, however, less easy to position the aircraft upon a given landing spot, because the descent begins from a height. It is, therefore, thought that a combination of the two approach procedures will prove practical.

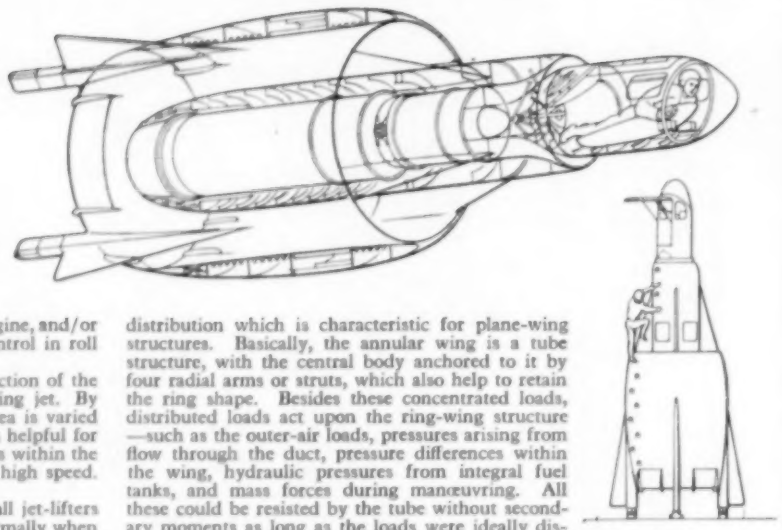
Descent is controlled by the downwards-deflected jet. This requires complex and accurate manœuvring. To adjust the sinking speed by thrust regulation until it becomes zero at the instant of touching the ground, and simultaneously to maintain steady vertical attitude by manipulating jet-control devices, is a very delicate manœuvre for the pilot. Manned coleopters will, therefore, be equipped with the same kind of fully automatic take-off and landing control as are guided and recoverable coleopters. This equipment is monitored by reliable and accurate distance-from-ground sensing and drift-recording devices, in combination with gyroscopic control. Flying tests have given complete satisfaction.

Contrary to expectation, compensation for drift during descent is not difficult. A 40-knot wind requires only 6 deg inclination of the coleopter axis. To prevent toppling after landing special precautions will be needed.

Apart from slipstream- or jet-exposed control surfaces, the deflection of the entire jet (either by deflectors, or by jet-pipe swivelling) or the provision of subsidiary steering jets would satisfy the coleopter requirements.

During S.N.E.C.M.A. experimentation, two steering methods were tried. One utilized the reaction of a deflected air jet upon the thrust-producing gas jet emanating from a turbojet. This was accomplished by actuation of the trailing-edge flaps in the annular wing, in the manner mentioned earlier. In this way, too, the flow through the duct could be restricted. The other method

WITHOUT VISIBLE MEANS OF SUPPORT . . .



The Brucho A piloted ground-attack fighter powered by an afterburning Atar. In addition to the data given on p. 862, this design is to have a minimum radius of turn of 3,280ft.

employed spoilers located within the jet-pipe of the engine, and/or lips close to the discharge orifice. In both cases, control in roll was effected by inducing rotation of the jet.

When the annular wing serves as a ramjet, a deflection of the trailing-edge flaps directly affects the thrust-producing jet. By moving these flaps in opposite directions the exit area is varied without deflecting the efflux. Such area restriction is helpful for avoiding the formation of any dangerous low pressures within the wing immediately after the ramjet is switched off at high speed. It may also help as an air brake.

Coleopter Propulsion. As this aircraft class, like all jet-lifters and helicopters near the ground, cannot be landed normally when the propulsion has become inoperative, manned coleopters must have either dual propulsion or duplicated propulsion units, each of which will be sufficient for safe descent.

For most coleopter projects, "combination propulsion" is preferable. For short periods of high speed flight, ramjet propulsion proves the lightest. This, however, demands that the aircraft is accelerated to operational speed by other means, e.g., by a rocket motor or by a turbojet, and that sufficient static thrust is available for ascent and descent. For manned or recoverable coleopters, ramjet propulsion alone is, therefore, considered impracticable. It is employed solely for boosting to high supersonic velocities.

For ascent, the static thrust should be at least 1.25 times the take-off weight; for landing it may be less, and a value equalling the landing weight would appear acceptable. Most currently used turbojets weigh around 0.3 lb/lb static thrust. This means that the weight of airframe, disposable load and fuel tanks should be equal to, or less than, half the static thrust. This is achievable, since a coleopter airframe weighs only about half of that of a comparable standard aeroplane. Lighter turbojets render the scheme even more practical. The latest Atar 101E turbojet, of 7,700 lb static thrust, weighs only 0.235 lb/lb thrust, and Dr-Ing. H. Oestrich, the designer of this engine, holds further weight reductions to be possible for coleopter installations. The expendable Rolls-Royce Soar turbojet weighs only 0.15 lb/lb static thrust.

S.N.E.C.M.A. investigations show that turbojets with reheat and with additional ramjet propulsion guarantee coleopter performances which are unattainable by any standard aircraft, quite apart from the take-off and landing advantages. The ramjet would be put into operation at speeds in excess of about 500 m.p.h.

As far as ramjet operation is concerned, the cross-section of the duct is oversized; this leads to relatively low combustion temperatures, structurally most desirable. Since, however, the velocity at which air enters the combustion space is high (of the order of Mach 0.3, in present projects), special burners have been developed, with shields and flameholders, designed to achieve sufficiently reduced local flow velocities for reliable combustion. The entry of these patented subsonic burners is shaped like a diffuser for a ram intake; high compression efficiency and low burner drag are claimed. Up to 33,000ft altitude, the pressure in the burner diffuser exceeds one atmosphere, decreasing to not less than half that pressure up to 66,000ft (where the internal flow velocity corresponds to about Mach 0.1). This safeguards the ramjet operation and makes it economical.

S.N.E.C.M.A. experimentation is at present concentrated upon the turbojet. A vertically ascending Atar engine with all flying controls is under test. As its tailpipe is located within the coleopter duct, forward of the wing trailing edge, the hot gas jet is surrounded by a cold air stream as long as the ramjet is inoperative (i.e., during launching and descent). By virtue of injector action, this airflow is present at any speed.

Ducted airscrews can produce a substantially higher static thrust than the free-running type, provided that the duct exit area is suitably chosen. Seibold claims more than 25 per cent static-thrust increase as attainable. Heating the airscrew slipstream might produce some acceleration; at present, such a method is not utilized, and it is scarcely economical.

Structural Features. The annular wing has 1.57 times the surface of a plane wing having the same span. Wing weight might therefore become prohibitive, and a high airframe weight would render the whole coleopter scheme impractical. H. Hertel investigated the structural possibilities from this aspect. He found that, in fact, coleopters can have much lower airframe weights than comparable standard aeroplanes.

The annular wing cannot be conceived as a plane wing bent into a ring shape, since closure to a ring renders the system statically three-fold indeterminate, thus completely modifying the stress distribution which is characteristic for plane-wing structures. Basically, the annular wing is a tube structure, with the central body anchored to it by four radial arms or struts, which also help to retain the ring shape. Besides these concentrated loads, distributed loads act upon the ring-wing structure —such as the outer-air loads, pressures arising from flow through the duct, pressure differences within the wing, hydraulic pressures from integral fuel tanks, and mass forces during manœuvring. All these could be resisted by the tube without secondary moments as long as the loads were ideally distributed. This, of course, cannot be assumed; stiffening-ring frames are therefore needed to preserve the circular cross-section of the stressed tube. Where tanks, radial struts and control flaps are located, substantial members are required for the transfer of loads; these correspond to the spars of a plane wing.

The aerofoil of a coleopter wing is only about 3.5 per cent chord (= length of annular duct) thick. In spite of this, and partly owing to relief by the radial strut bracing, the skin sheets required are very thin. In certain unfavourable circumstances, however, the use of such skins may lead to critical stiffness and structural instability.

According to H. Hertel, minimum weight and satisfactory stiffness and stability (as well as easier manufacture) are obtained when one only of the two wing surfaces is constituted by a structurally substantial stressed skin; the other surface can be an unstressed fairing. This interesting development leads to the *single*-walled shell structure, which is characteristic for all coleopter wings. In the case of ramjet propulsion, the outer wing skin forms the shell, whilst for slower coleopters the inner duct surface is constituted by the stressed-shell skin. In all cases, the stressed skin is reinforced by numerous light ring frames, in accordance with the load distribution, so as to retain the local stability of the skin. In addition, more substantial ring-frame structures are provided, as mentioned.

Since the structural parts of such a single-walled shell are perfectly accessible, manufacture, inspection and maintenance become easy; also, installations buried within the thin wing are conveniently housed.

Tanks and other containers form an integral part of the annular wing. For the assembly of such items Hertel proposes a rather neat solution by sliding two finished halves over each other, with freely accessible final joints. To resist internal loads arising from high-pressure feeds, rib-like stiffeners are incorporated. Envisaged, too, is local support of the stressed skin by foamed stabilized plastics bonded to it. This practice is already adopted for large research models and for non-recoverable missiles.

H. Hertel has proved that such an annular wing structure weighs less than 40 per cent of that of a plane wing having equal strength and span, in spite of the larger surface. Full use is made of magnesium alloys.

General Assessment. The drag of the annular wing is, at optimum cruising speed, 1.25 times that of a plane wing having the same lift and equal aspect-ratio. The higher cruising thrust required demands more fuel and would, *a priori*, handicap the coleopter on account of greater take-off weight.

In fact, however, the airframe weight of a coleopter is only 24 per cent of the launching weight (compared with 33 per cent for the corresponding conventional aeroplane having the same aspect ratio and the same specific powerplant weight. Thus the drag penalty is well compensated until long ranges or durations are considered. For airscrew drive, the ducting would allow reduction of the take-off power against that needed for V.T.O. aircraft of the "pogo-stick" variety.

Over ranges in excess of about 2,000 miles, the plane-wing aeroplane attains better economy in cruising flight. In other respects, however, superiority is claimed in favour of the coleopter, provided that the powerplants have a reasonably low specific weight.

Since the annular wing is aerodynamically better than the cross-wing configuration, it should be preferable for missiles designed for high manœuvrability.

The influence of low specific powerplant weight is easily seen from the single-seater intercepter project "Charançon IV" (see table). With a specific turbojet weight of 0.3 lb/lb static thrust, the launching weight is about 3 tons for 60 miles radius of action. A specific powerplant weight of 0.20 lb/lb thrust leads to only

1,900 lb launching weight, and the installation of Soar-quality turbojets would reduce the launching weight to 1,450 lb and widen the radius of action to 100 miles or more. In all cases, the same wing loading and military load are assumed.

Complete independence from aerodromes, runways or carrier decks (in spite of high supersonic velocities), coupled with compactness and small dimensions, are, of course, features which no other aircraft type can offer at present. Needing no booster rockets or similar pyrotechnics, the launching can produce no treacherous smoke signal for the enemy, and no special launching device is required. Coleopters are easy to transport, to store and to shelter; this commends them for use on board ships of any kind.

Immensely valuable is the possibility of recovering unmanned guided coleopters. Current projects, therefore, include an unmanned mail carrier and a weapon carrier, i.e., a pilotless fighter aeroplane for interception. For self-destructive guided weapons, the advantages derived from eventual recovery (after failing to make contact with the target) are two-fold. Firstly, ground-damage from one's own defence means can be avoided—a very important point, which may allow the employment of warheads otherwise either too costly or too dangerous for use over populated districts, troops or vessels. Secondly, since the economy of guided-missile defence is, at the present state of the technique, gravely in doubt, a non-expendable, easily recoverable missile such as the coleopter should be valued highly. In addition, the exceptional performance in climb, speed and manœuvrability, on the strength of plain fuels and without need for booster rockets, may be appreciated.

With its automaticity in launching and descent, with its freedom from stalling, and with its ability to hover, the manned coleopter should, in relation to its high performance, require less skill and training in its pilots than do conventional high-speed aeroplanes and helicopters.

From the safety aspect of view, the coleopter shares with all jet lifters and with the helicopter (when close to the ground) the inability to land normally should the means of propulsion become inoperative.

Manned coleopters, therefore, may have to have twin or dual propulsion, of which one part alone is sufficient for a controlled descent. Besides, baling out by parachute, or jettisoning of a cabin "capsule" involving parachute or rotor descent, seems safe and easy with the coleopter since this aircraft can be brought to zero forward speed in case of a mishap. This should be a considerable advantage in comparison with the high-speed aeroplane and its necessity to shed the crew at high speed.

Compared with high-speed aeroplanes and with helicopters, the coleopter is a simple aircraft. Its few mechanical components could be designed to be trouble-free, and it should be cheap in initial cost and in maintenance. High reliability and good economy may therefore be expected.

MAGNESIUM ANNIVERSARY

TWENTY-ONE years ago, a newly-formed British company acquired from the I.G. Farbenindustrie of Germany (then one of the world's largest producers of magnesium) rights to produce the metal by the process of thermal electrolysis of anhydrous magnesium chloride. The new firm was Magnesium Elektron, Ltd., and its first plant began operation in 1936, producing 1,500 tons a year of magnesium and alloys.

Magnesium, which is 40 per cent lighter than aluminium, soon became a factor of considerable importance in the air re-armament programme, and by 1941 the United Kingdom firm had increased their production by a further 5,000 tons per annum. In the same year, a new plant was built in Lancashire; and the company also designed, and helped to construct and operate for the U.S.A., one of the largest magnesium plants in the world; situated at Henderson, near Las Vegas in Nevada, this new factory was capable of an annual output of 50,000 tons.

During the war years, research was devoted to immediate problems, but great progress has since been made in the development of new ultra-light alloys possessing the increased mechanical properties demanded by the aircraft and aero-engine industry. It had been discovered by Professor Sauerwald in 1938 that a small addition or zirconium caused intense grain refinement of magnesium; but it took many years of metallurgical and chemical research to find methods of alloying this element. With the assistance of certain of its United Kingdom licensees, the company introduced, early in 1947, a series of magnesium-zirconium-zinc alloys for airframe use, and magnesium-zirconium-zinc rare-earth alloys for use in engines. The former gave good uniform strength at normal temperatures, and the other provided high creep-resistance at operating temperatures up to 250 deg C.

These successful alloys, together with the more recent magnesium-zirconium-zinc-thorium, are now standard aircraft and engine materials. A total of 26 companies at home and abroad have taken licences to use Magnesium Elektron's patent processes.

To mark its 21st anniversary, the company invited representatives of all its licensees to visit the works at Clifton Junction on June 16th and 17th. Almost every licensee firm was represented; some short papers were read covering recent developments in the field of magnesium, and a number of discussions were held. Also, with the collaboration of the leading British founders, fabricators and users of "Elektron" magnesium alloys, a remarkably representative exhibition was staged.

ROLLS-ROYCE INTENTIONS

A HINT about the future of the Rolls-Royce RB.109 engine is given by Lord Hives, the company's chairman, in his statement issued in advance of the annual general meeting (to be held at Derby on July 5th).

"Last year," he says, "I indicated that our experience of propeller turbine engines had convinced us that this type of engine would probably play the biggest rôle in civil aviation for some years ahead. At that time we were well advanced with an improved specification, and our new engine, designated RB.109, has now started its programme of development running. We are confident that it will be a worthy successor to the Dart."

In his review of the company's military-aviation products, he mentions that the manufacture of Avons by the Bristol Aeroplane Company was discontinued during 1954 and the production of these engines by the Standard Motor Company and D. Napier and Son, "should be terminated during the current year, after which all Avon engine production will be concentrated in our own group of factories." This, he adds, brings to an end an emergency measure most effectively carried through and providing an example of what can be achieved by a high degree of co-operation between people in the same industry.

Lord Hives concludes his report on the aero-engine division by saying: "Among the many problems which confront the engine builder today is the particular problem of testing engines under the conditions to be expected at very high altitudes. Your directors consider that it is of such great importance that the company should have its own facilities, even though these represent a very substantial expenditure. Contracts of the order of £2 million are already placed or under discussion."

Earlier in his statement the chairman indicated an important change in the system whereby Rolls-Royce employees hold shares in the business. The existing scheme, under which £145,000 of workers' stock—as the shares are known—is held by employees was introduced in 1920 and was probably unique at that time. Today the amount is far too small in relation to the company's issued capital—it is less than 2½ per cent—to achieve the original object of the scheme. The chairman's statement says that fewer than 6 per cent of the employees own workers' stock; two-thirds of these hold £50 or less; and only six hold more than £500. These holdings were acquired prior to 1934 and none of the holders is a director. The Board has accordingly decided to terminate the existing arrangement and "to replace it by a larger and more flexible scheme, which will enable a far greater proportion of the employees to participate and to hold approximately ten per cent of the issued equity capital." Accordingly, it is proposed to create £600,000 in workers' shares of 10s each.

ROAD TRANSPORT COST TABLES

A GREAT deal of information of value to transport operators is contained in *"Motor Transport" Cost Tables*, now available. The tables cover most vehicle types (petrol and diesel) and include employment costs in addition to running expenses. All the figures given are averages of basic data provided by a number of operators and manufacturers, and the commercial-vehicle user can thus compare his own figures with the normal. The booklet includes a cost reckoner—useful also to the ordinary motorist—to convert m.p.g. into pence per mile. Price is one shilling, from booksellers, or 1s 2d including postage, from Iliffe and Sons, Ltd., Dorset House, Stamford Street, London, S.E.1.

The two Lockheed C-130 Hercules transports (left) are prototypes for an important fleet for the U.S.A.F. Performance has exceeded expectations and speed is claimed to beat that of "luxury liners"; yet the C-130 is said to take off and land, at light weight, in as little as eight fuselage-lengths. In the lower view are the first, second and third prototypes (attack, all-weather fighter and bomber) of the S.N.C.A.S.O. 4050 Vautour.

AIRCRAFT INTELLIGENCE

U.S.A.

Aero Commander 560. A "commuting" aircraft of this type (an air test was published in *Flight* of December 24th, 1954) is being used by President Eisenhower to make the 80-mile trip from Washington to his Gettysburg farm. The President feels that it is safer to fly on this journey than to make it by car. The "560" weighs 6,000 lb all-up, is powered by two six-cylinder Lycoming GO-480-B engines of 270 h.p., cruises on 70 per cent power at 10,000ft at 197 m.p.h., and stalls at about 59 m.p.h.

McDonnell F-101A Voodoo. The world's largest and most powerful single-seater, the Voodoo—subject of this week's general-arrangement drawing—is a supersonic fighter, capable also of carrying atomic weapons. Production machines will be assigned to Strategic Air Command. The number of Voodoos on order has not been divulged, but in November last year it was announced that the manufacturers had received a U.S.A.F. contract for over 100 million dollars' worth of "additional" machines of the type. Few structural details are available, but it is known that the wing skin consists of heavy, tapered, preformed sections. Additional to the vast internal capacity, provision is made for external tanks. A photographic reconnaissance version is under development. Some months ago it was announced that a staff of 45 McDonnell engineers and technicians was to be stationed at Edwards Air Force Base, California, for about one year for the purpose of conducting an intensive flight-test programme on the Voodoo.

Aircraft for NATO. It is reported that the following are the approximate totals of M.D.A.P. aircraft supplied to, or scheduled for, the European members of NATO: 1951-4, 2,000 Republic F-84E and G; 1955-62, 2,000 Republic F-84F, RF-84F and North American F-86F and F-86K; 1962-70, 2,000 North American F-100 variants and Republic F-105s.

Czechoslovakia

Motokov Types. At the recent air display in connection with the Canadian International Trade Fair a Motokov Zlin 126 Trener, powered by a 105 h.p. Walter Minor 4-112 engine, seems to have stolen the show. Also on view at the Fair were a two-seat LF 109 Pionyr sailplane and a five-seater Aero 45 executive aircraft. With two Walter Minor 4-3 engines, the Aero 45 cruises, on 75 per cent power, at 152 m.p.h. It is hoped to find Canadian and American markets for this last-named machine at a price of about $36,000.

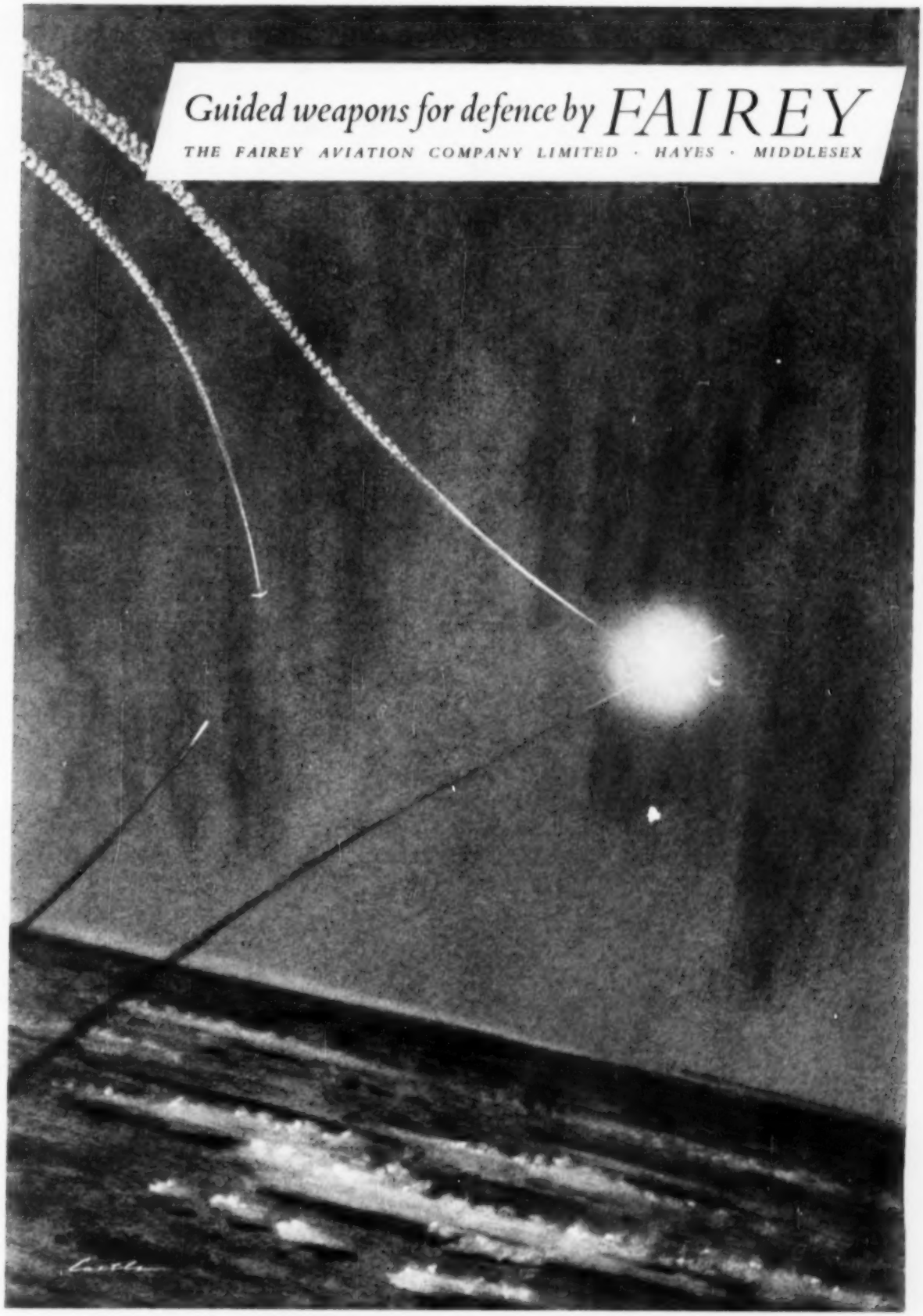
France

Fouga CM 170 Magister. Five Italian officers have been at Mont-de-Marsan evaluating the Fouga Magister light twin-jet trainer, and have made several flights. A Canadian mission is also to evaluate the Magister.

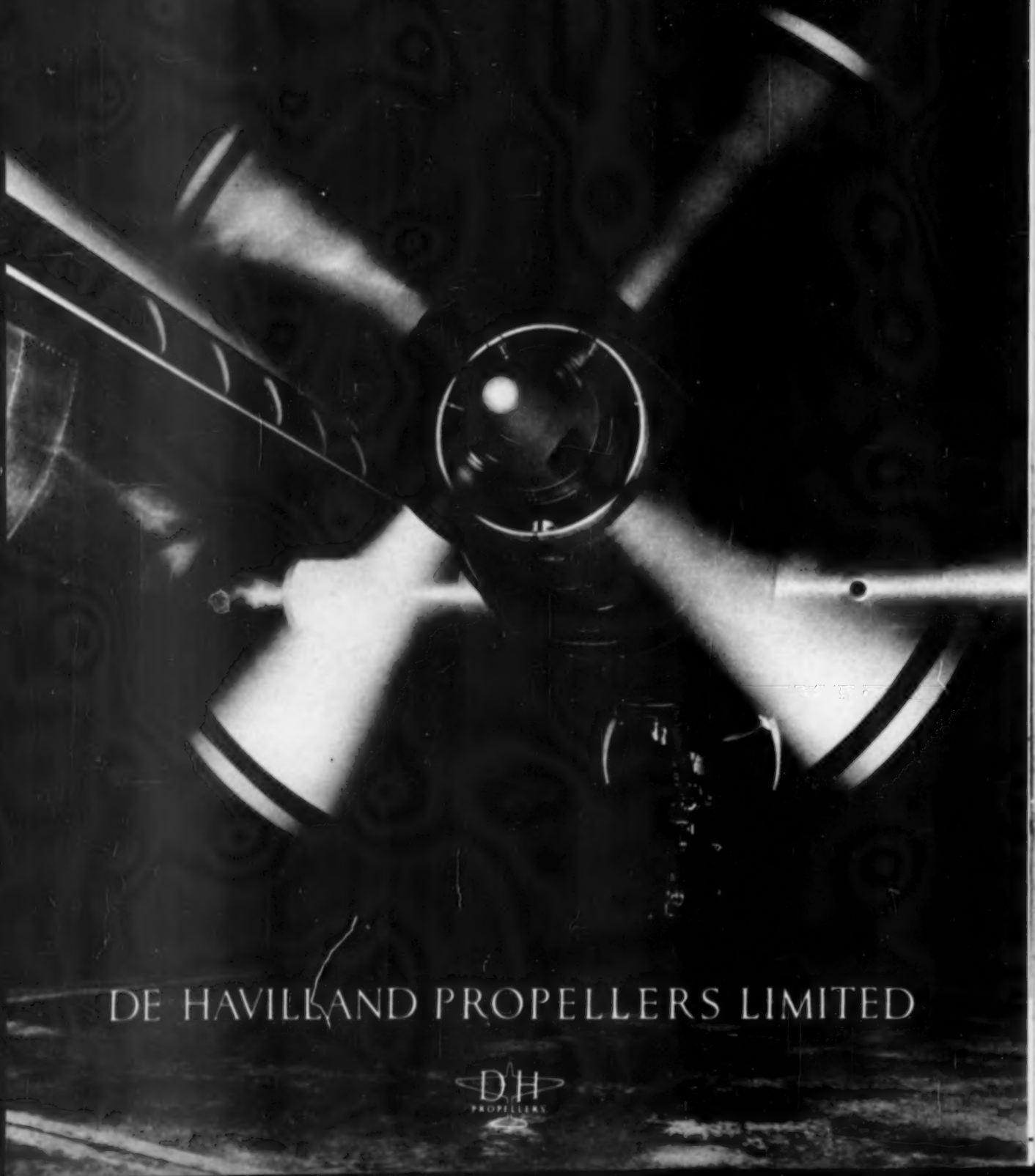
Boisavia Anjou. Three pre-production aircraft of this type (twin-engined 4/5-seater) are more or less complete in the S.N.C.A.N. works at Méaulte, and two prototypes are ready at the Boisavia factory. The Anjou is expected to cruise at 165 m.p.h. and to have a range of 1,240 miles. The engines are 170 h.p. S.N.E.C.M.A. 4Ls.

Sweden

Saab A.32 Lansen. An unconfirmed report from Italy states that Sweden "has the intention of selling the Lansen in Argentina." Development of the Lansen has now reached an advanced stage, and production of several versions is confidently predicted to yield operational machines early next year. All will be powered by S.F.A.-built Avons.


Guided weapons for defence by FAIREY
THE FAIREY AVIATION COMPANY LIMITED · HAYES · MIDDLESEX

de Havilland hollow-steel-blade, constant-speed feathering and reversing propellers are being fitted to the fleet of Bristol Britannia (Four Bristol Proteus propeller-turbine engines) aircraft on order for the British Overseas Airways Corporation



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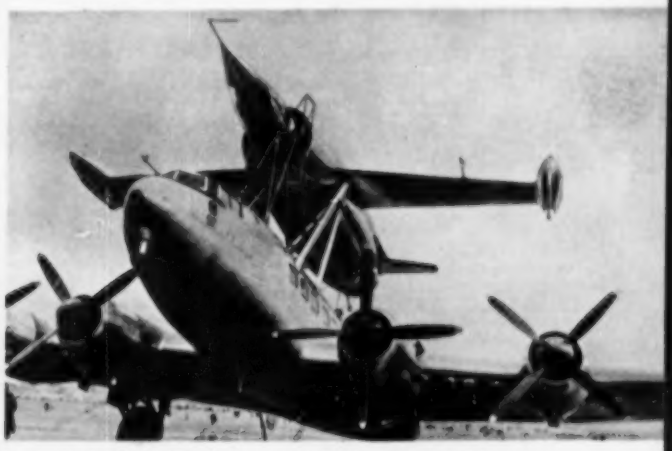
PROPELLERS

WEEK-END IN PARIS

Variety and Spectacle in the Grand Manner



(Above) The sunshades (which served as umbrellas), the straining tricolors, and the Patrouille de France. (Right) The Leduc 021.

The Espadon, which stood in for the Trident on Sunday.

The Trident rockets away for Saturday's performance.

THAT delectable concoction of science and art which is the Paris Salon was relished to the full on Saturday and Sunday when international displays of superb quality topped off a week rich in air-fare. In its variety and proportions the occasion was without precedent, though it must be recognized that these displays at Le Bourget differ in purpose and character from our own great trade demonstrations at Farnborough. And not the least contribution was that of Britain.

With the disaster of Le Mans still brooding in the public mind, elaborate, and necessarily restrictive, precautions had been taken; but on Saturday, when the sun shone (as it did for much of the day) the scene lacked little of its characteristic vivacity.

Spectators were massed in enclosures 130 metres from the runway and even cameramen were caged in a narrow walkway immediately in front. Pilots had been warned to make their fast passes along the runway, not lower than 100 metres; and standing by were 50 ambulances, 250 doctors, 40 fast cars and a flight of helicopters. In the event there were no incidents of any consequence.

President Coty arrived late on Saturday afternoon and visitors earlier in the week had included Prince Bernhard, Sir Gladwyn Jebb and Herr Theodor Blank.

Sunday was a sullen, blustering day, with a shower-laden sky which denied any freedom of aerobatic movement, and a wind that viciously uprooted the big sunshades in the enclosures. But much of the programme went through to plan, and our account is, in the main, a composite one, covering both days, and without meticulous attention to order of events.

The early flying (for the first machines were in the air around 10 a.m.) was a light affair of circuses, with gliders playing a part on Saturday. For the record, there were some pretty performances by the Tripacer, Super-Cub, Jodel-Wassmer, Jodel-Lutétia and Rondone, Cessna 180, Super Cigale, Nord 3200, Monitor III and Broussard. Gliders were the Hirondelle SZDO8, Mouche SZD12 and Cigogne SZD9, and in military garb were the Potez 75 "police" aircraft (as it is now called) and the N.C.856, launched by "l'Arbalète," which catapults it into the air in 65ft and enables it to land, with arrester, in 40ft. On Saturday, when the sky was fairly clear, two groups of parachutists made delayed drops. Three men landed squarely on the airfield but ten (who delayed for 90 sec) touched down far off.

Britain's three Fairey Gannets (by courtesy of the Admiralty) made great play with their Double Mambas, dual Rotols, hooks,

(Above) Meteor N.F.11 with ramjet. (Below, left to right) one of the Baroudeurs, the Super Mystère B1, and the Leduc, alone at last.

Two weighty British visitors for Saturday's show: the Handley Page Victor, and Bristol Britannia G-ANBB, with two Proteus shut down.

The Avro Vulcan makes a leisurely promenade on Saturday.

A new shape in the air—the S.N.C.A.S.E. Caravelle transport.

WEEK-END IN PARIS . . .

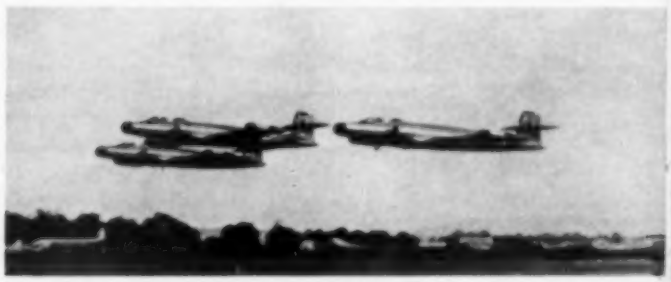
bomb doors, radomes and so forth, and the T.2 (the others were A.S.1s) put up an especially breezy show, with bomb bay open and yet at a surprising rate of knots. Short's Seamew, too, kept the Red Ensign hoisted high, with its short leap-off and helicopterish hovering propensities. An endearing aeroplane to watch. So, too, was M. Payen's PA.49 Flechair, a miniature research delta, with a Turboméca Palas, fixed undercarriage and (one gathered) little or no future. Likewise Palas-powered came the Sipa 300 tandem-seat trainer, which flew quite strongly considering its "feeble push," and may reap where its precursor, the S.200 Minijet, has sown.

The elegant form of the Fouga CM170R Magister is becoming increasingly familiar; but a close formation of four—all tip-tanked—was really something to take the fancy, especially when it became known that the three leading pilots (air force instructors) each had only 20 hours of jet-time—all in Magisters. In the box was test-pilot Grangette, who put on a professional show, notable for its slow, sibilant Duke-ish rolls. The Morane Fleuret was in fine fettle, as well it might be, for it was being whispered that Beechcraft may construct up to 1,000 examples of its derivative, the Paris.

Handsome in silver, blue and yellow, Fokker's S.14 spun, Derry-turned and was otherwise conducted by Gerben Sonderman in a most impressive and reassuring fashion; and the Vampire Trainer (Thornton) got in on the Duke-slow-roll act. Fiat's tandem-seat, Nene-powered G.82 impressed by its very steep initial climb—as, indeed, did a number of others, for the wind was strong up the runway.

A dozen blue S.E. Aquilons (D.H. Sea Venom development) formed themselves into a creditable anchor, and test pilot Lecarme did a JATO take-off and some uninhibited aerobatics in a similar machine. As distinct from the Sea Venom the Aquilon has a sliding canopy, and Lecarme (father of eight, it was announced) landed with it open.

When two Hurel-Dubois H.D.32s (Ponthus and Marchandeau) took the air the sky seemed half-full of wings, struts and fins. These two strange (but eminently useful) birds wheeled tightly around like a pair of noisy vultures. Spritely, too, and very smart, was U.A.T.'s Noratlas (Perin) with tip-mounted auxiliary Marboré IIs; but for sheer good looks an Air France Viscount was supreme among its kind. In support of the claim that it is the



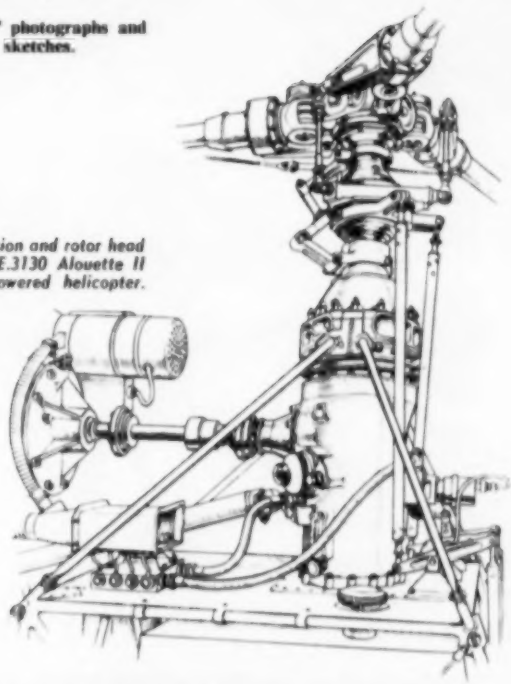
(Above) The Hunter aerobatic team of No. 43 Squadron, R.A.F. (Upper right) The Avro Canada CF-100s of the R.C.A.F. get going. (Lower left) Smart work by the four S.N.C.A.S.O. Vautours. (Lower right) Dassault Ouragons of the Patrouille de France.

"Flight" photographs and sketches.

These S.N.C.A.S.O. Djinns were part of a busy circus of five.

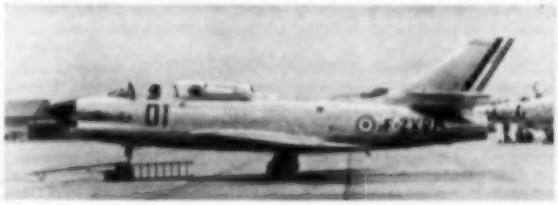
An American in Paris—a Piasecki HUP-2, of the French Navy.

The S.E. Alouette II gives a lift to a 2 c.v. Citroen van.



Transmission and rotor head of the S.E.3130 Alouette II turbine-powered helicopter.

The recently modified S.N.C.A.N. Gerfaut 1402B delta.



Marcel Dassault Mystère IVN two-seat all-weather fighter.

(Above) The Payen delta consorts with the Sipa 300 trainer. (Below) S.E. Aquilon, a French-built version of the D.H. Sea Venom.

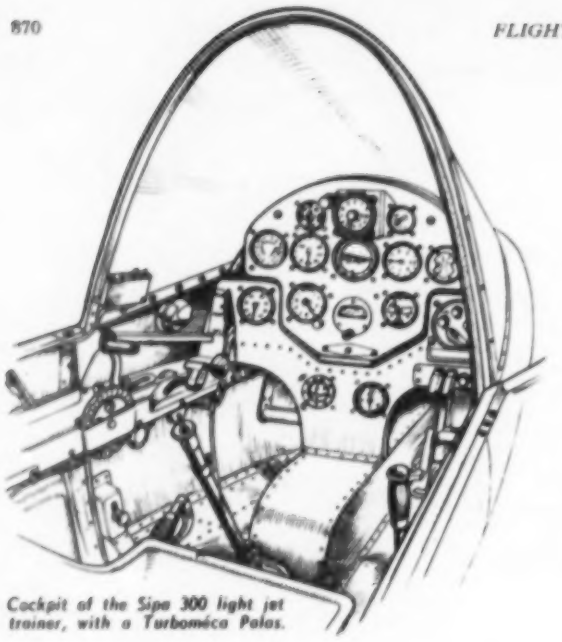
only civil transport licensed to carry over 100 passengers, the Bréguet Deux Ponts set down 110, after a very short reverse-pitch landing. The pilot was Bruneau who, as a family man, is only one or two down on Lecarme.

In our own estimation the three Avro Canada CF-100s of the R.C.A.F. provided one of the most welcome spectacles of all. An earnest of NATO squadrons yet to come, these heavy, but distinctly agile, all-weather two-seaters rushed thunderously through the sodden air, precipitating and streaming water. Derry turns, fast rolls and lengthy inversions they took in their stride.

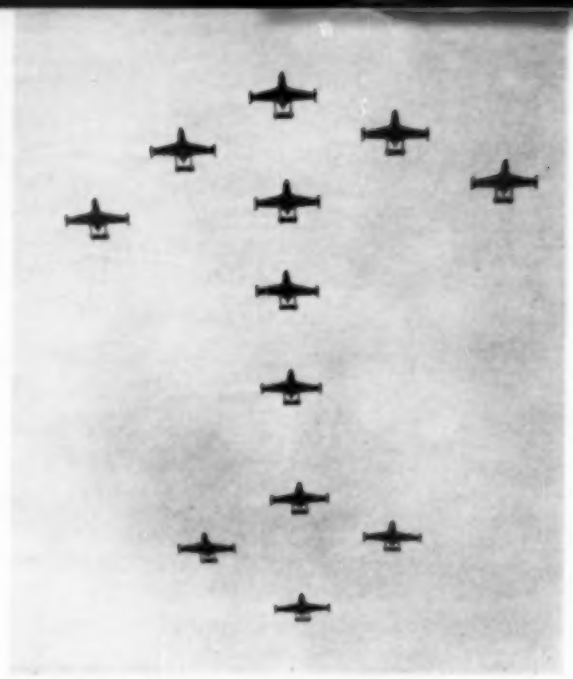
On Saturday a Vulcan and a Victor swept over in their respective styles, and on Sunday, when gaps began to yawn (together with at least one spectator), an Air France Super Constellation and a U.A.T. DC-6B contributed yet more dignity to the occasion.

The Alouette II helicopter made excellent use of its 360 c.v. Artouste to whisk a 2 c.v. van pendulously around; five Djinns chugged busily about, whistling while they worked; and those stalwart British rotarians, the Bristol 171 and 173, the Saunders-Roe Skeeter and a French Navy Piasecki HUP-2 all contributed worthily.

The internationally respected house of Marcel Dassault was represented in formidable strength. In the elegance and precision of their manœuvres the four Ouragans of the Patrouille Acrobatique de France rivalled the peerless Skyblazers of the U.S.A.F. A Mystère II, with jet-deviation Atar, showed that Bristol have not been mistaken in securing their licence for the brilliantly conceived S.N.E.C.M.A. deviator; Mystère IVs flown by Lacolle and Morel (Morel's machine had an Atar 101F, with reheat) gave of their excellent best; and Commandant Boudier demonstrated the truly terrific performance, in terms of speed, acceleration and rate of roll, of the Super Mystère. Nor was this all, for on Saturday the all-weather two-seater fighter



Cockpit of the Sipa 300 light jet trainer, with a Turboméca Palas.



S.E. Aquilons of the French Navy form the emblem of their Service.

WEEK-END IN PARIS . . .

Mystère IVN set out, with General Corniglion-Molinier, Minister of Public Works, as passenger, with the avowed intention of reaching Nice in 37 minutes. As things turned out it was 43 minutes late. The twelve Mystère IVs of the Cambrai wing which were to have banged, so to speak, in uni-son, had to content themselves with less ambitious but none the less impressive manœuvres.

Three demonstrations of quite exceptional interest and significance, which were confined to Saturday, were those by two S.E. Baroudeur trolley-launched, tactical-support fighters flown by Maulandi and Petit; the Leduc experimental air-launched ramjet aircraft; and the S.O. Trident supersonic turbojet-*cum*-rocket research fighter. The two Baroudeurs in particular were given a thorough working out, over the full range of take-offs and landings, with and without trolley. One of them actually carried its trolley round the circuit and made a good landing with it still attached, while the second, having failed to find Le Bourget with a sonic bang, consoled itself by rolling overhead. Both used a braking parachute, which was released just before touching down in a cloud of dust on the hard grass borders of the runway.

The first public demonstration of the launching of the Leduc from its Languedoc carrier was even more of a sensation. Separation occurred at 1,200ft, and the light-up immediately afterwards. Under power the Leduc made two very quiet runs over the field, first at 440 m.p.h. and then at over 600 m.p.h. Power was cut over the runway and followed by an S-curve approach. The ribbon tail parachute was streamed while the machine was 10ft above the ground. All praise to the Leduc pilots, Litholff, Gonord and Périn.

The Trident taxied out, lurching on its very-narrow-track undercarriage, while its pilot, M. Goujon, was proclaimed as the fastest man in Europe. It took off, lengthily, on the power of the two tip-mounted Armstrong Siddeley/Dassault Viper turbojets and on one barrel of the SEPR rocket, and climbed away with unparalleled steepness until only a speck of flame was visible in the sky. Then the rocket was cut with a puff of white chemical smoke, and Goujon returned to make two searing passes, before landing from a long, straight final approach and rolling for almost the entire length of the runway. On Sunday the Trident's place was filled by a hardly less awe-inspiring Espadon. People flinched even when the rocket was lit some hundreds of feet up. More fiercely flaming, though less noisy, was the ramjet under one wing of S.N.C.A.N.'s Meteor N.F.11. The unconventional powerplant is offset on the opposite side by a tank. Another Nord representative—and one which depends solely on a S.N.E.C.M.A.

The Fouga CM.170R Magisters get into their stride.

North American F-86F Sabres—the peerless "Skyblazers."
S.N.C.A.S.O. 4050 Vautour No. 05 caught behind the scenes.

The Noratlas of U.A.T., with tip-mounted auxiliary Marboré IIs.

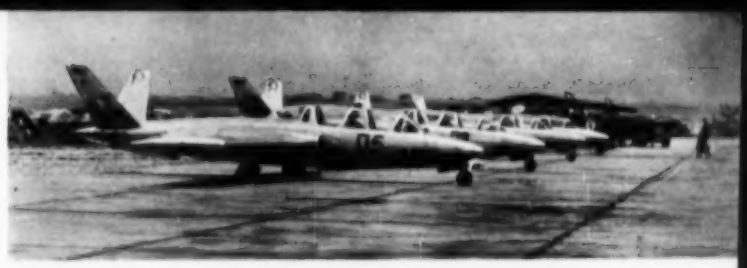
Atar 101D turbojet for its level-supersonic performance—was the delta-wing Gerfaut 1402B research fighter, a machine of singular appearance and prepossessing performance, lately the subject of considerable modifications, in evidence on page 869. The tail "bullet" has been much enlarged and supplementary fin surfaces added. The Nord organization have also been responsible for the conversion of a phototype Mistral to take a ski undercarriage, the units whereof are about 18in long and quite narrow. This aircraft showed that it can comfortably take off, land and taxi on grass—not, however, without creating some considerable dust. This undercarriage, and that of the Baroudeur, were discussed by M. Georges Hereil in a lecture abstracted in *Flight* of March 25th, 1955. M. Hereil also described the principle of l'Arbalète, earlier referred to in connection with the N.C.856.

By now our remark concerning variety and richness of fare may have been appreciated. But there were more courses to follow.

Something especially French was the formation of four prototype and pre-production S.O. Vautours, which left no one in any doubt that in this type France has a truly multi-purpose fighter/bomber/reconnaissance aircraft of very high performance indeed. An individual machine showed a remarkable rate of roll for one of its size. Take-off and landing runs are quite modest, and to illustrate their claim that the "B" version can release its load at full speed the makers had an internal bomb load painted yellow, and this was exposed in very fast runs. The pilots of the Vautours were Fischl, Richard, Blanc and Guignard.

In the all-weather fighter category the Vautour is closely comparable with the Gloster Javelin, though the Javelin's low wing loading confers upon it unique qualities, which were quickly manifest in Geoff Worral's breathtaking climb from a short take-off and his astonishingly tight manœuvres. In sheer speed, too, the Javelin did not belie its name. Here we may put in a word concerning the remaining British representation. The Britannia (Bill Pegg) was quiet efficiency itself, though it was unlucky enough to burst a tyre after demonstrating a cross-wind landing with two Proteus out on one side. Another Britannia delivered tyres from Filton, and both departed, to proceed with development flying.

The aerobatic Hunters of No. 43 Squadron (*les ambassadeurs du Raff*) flew superbly, though at wider spacing than the Skyblazers; and they made a colourful sight with their checkerboard markings. On the Saturday Neville Duke was literally "bang on," for his Hunter F.4 arrived with the percussion itself. His was not the only bang, but it was the biggest and best. And had his show not been so brilliant as, of course, it was, his very name, coupled with that of the "*untair*," would have thrilled the assembly. Peter Hillwood, in the Canberra T.4, did an "upward eight" and showed that the Vautour is by no means alone in the high-speed twin-jet business. On Sunday his compact manœuvres beneath the gloom were truly appreciated, particularly by Britons.



Fouga CM.170Rs and S.E. Aquilons (D.H. Sea Venom licence).

The Fiat G.82 is a Nene-powered trainer of high performance.

At every big show, of course, there should be some particular outlet for national feeling, and France's this year was the appearance of the S.E. Caravelle twin-Avon airliner which, having first flown on May 27th, had accumulated over twenty hours by Sunday. Observers who should know spoke well of the machine, and surely, if early behaviour is significant, the future looks promising. In the main, test pilot Nadot's flying was restrained, but on one occasion he suddenly opened up the Avons and eased the graceful liner into a full-power climb. "Bravo Nadot," enthused the commentator, "Bravo Caravelle." And so say all of us.

The U.S.A.F. showed how an F-84F Thunderstreak with two very large and two medium-large under-wing tanks derives welcome assistance from JATO, and to set the seal on the show there were the Skyblazers, in their F-86Fs. Especially marvellous were their low formation rolls; and their shattering "bomb burst" break-up seemed almost atomic in its intensity.

When will some other team show them the way home?

A SHOW-WEEK LOG

THE following notes and impressions are rendered by *Flight's* editorial representative, who remained for the duration of the show:

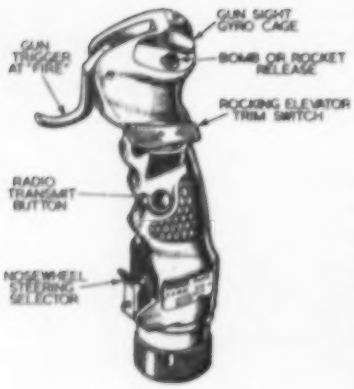
The Fiat test pilot, Sig. Sanseverino, brought the Nene-engined G.82 from Milan in one hop at the beginning of the week. The results achieved, and yet expected, from this machine are noteworthy. Performance is steadily being improved and the next step will be the installation of another mark of Nene with 400 lb more thrust. Recently the fin was extended forward considerably and the bullet at the tailplane was suppressed. It is also intended to fit Martin Baker Mk.4 lightweight ejector seats instead of the present Mk.2s, the extra space thus made available being used to provide two control-and-switch consoles which will greatly improve the cockpit layout. As for performance, Sanseverino said that the aircraft could reach 0.88 Mach in a dive, under full control; at that speed the aerodynamic trim-tabs are fully effective and the aircraft can be put into a loop. The ailerons have Fairey hydraulic assisters. Present sea-level speed limitation is 520 kt. The next step in performance will take the G.82 beyond 0.9 Mach, and this still with wing-tip tanks in place. Auxiliary tanks have also been provided, for attachment to pylons close by the main undercarriage legs. The pylons can also carry a variety of bomb and rocket loads, supplementing the two 0.5in guns already mounted in the nose.

On Wednesday I had the chance to fly the C.M.170R Magister with M. Bourrieau, chief test pilot of Fouga. We were too rushed to look over the aircraft first, and I spent the time it took to taxi out peering over the top of my A13A pressure-breathing oxygen mask and locating the various controls. These are very well arranged and correspond to the latest fighter layout: the twin throttles have twist-grip gunsight-ranging control and an airbrake switch at the end. On the stick are nose-wheel steering; gun trigger; gunsight gyro-cage and bomb-release button; transmit button; and elevator-trim rocker switch. Brakes are toe-operated, and flaps and undercarriage are switched electrically. Instruments are few and neatly set out. The periscope in the rear cockpit gives an excellent view ahead through the gunsight screen; in fact, day and night landings and take-offs have been made quite comfortably with its aid. I was able to take over for a couple of rolls and some turns. The controls are very light and positive and trim effective to the right degree. The Magister has a Mach performance better than the Meteor's and is far lighter and more responsive.

Lunching with M. Bourrieau afterwards we discovered that we were both celebrating birthdays—he his 47th—and he recalled some of his previous test flights. He has made the first flight of every Fouga aircraft and every Turboméca engine so far. Twice he has baled out. The first time was when aileron flutter caused the wing of the C.M.10 cargo glider to break off during overspeed diving tests. He was thrown through the windscreen, but despite a double fracture of the skull managed to pull the ripcord and land safely. On the other occasion the tail of the Cyclope powered glider came off during a demonstration at low level. Luckily the cockpit section went upwards and gave Bourrieau just enough height to bale out.

I heard that the C.M.191 four-seat liaison aircraft is not likely to be built, but that the C.M.171 is a test aircraft for a projected twin Gabizo-powered, swept-wing, butterfly-tailed trainer called the C.M.195. On the C.M.170 it was impossible to notice any strange effects at all from the butterfly tail, and one can hope that the C.M.195 will be the same. The navalized version of the C.M.170, bearing the suffix letter M, is now being built. Apart from the addition of a tail hook, the two canopies will be jettisonable in one piece, the oleos longer and some items of equipment different. Undoubtedly the Magister is an excellent aircraft, and the fact that a considerable production order has been placed, and a NATO recommendation conferred, should encourage the company to repeat their initial success.

On Tuesday I flew in the little 2/3-seater Ambrosini F.7 Rondone. There was a great rush on this aircraft all through the show, and I was paired off with Pierre Maulandi, the test pilot of the S.E.5000 Baroudeur. It was his first flight in the Rondone and I watched with great interest as he settled down to assess it. It was not possible to gauge cruising performance since the r.p.m. counter cable from the Continental 90 h.p. engine was temporarily out of commission. Maulandi, however, liked the



S.A.M.M. control-column grip as used on the Fouga Magister.

WEEK-END IN PARIS . . .

machine very much, and had no criticisms, except that the flap and undercarriage handle got badly tangled up when full flap was selected and that the throttle, fitted with a press-button friction-lock, was a little awkward for large hands. These features will probably be modified.

Stability and control were good. A little more elevator trim-tab range would have been desirable because full flap could not be trimmed out with throttle closed. With two people, both in front, the c.g. was right forward, but an extra person in the back would have remedied this condition. As a light communications and touring aircraft the Rondone is excellent, the cabin being both comfortable and quiet.

Maulandi told me something of the Baroudeur. It is now completely developed and ready for service, but only a pre-series of three is ordered and these will be used for tactical trials by the French Air Force. Some trouble was experienced with snaking, but this was cured by fitting a S.F.E.N.A. yaw stabilizer. There are signs of hard work on both prototypes (on the underside, particularly, where skid landing naturally causes a certain amount of wear and tear), and thick sections of sheet have been riveted on to the fin between the fuselage and tailplane. The latter is variable in incidence and built in one block with the upper section of the fin. Both, therefore, move together.

One prototype has a dorsal spine, the first four or five feet of which slides back with the canopy, but the other aircraft simply has a large glass-cloth fairing behind the hood transparency. This aircraft also has three flush load-attachments under each wing, and both have the Atar with variable-area nozzle, but no afterburner. The boundary layer deflectors at the intakes show signs of considerable tinsmithy and have been carried some way forward.

The controls are fully powered, with hydraulic plain feel for rudder and ailerons, and manual reversion. The object of the hydraulic feel is that, should a hydraulic leak occur and put the control out of action, the feel loads will also disappear and make manual loads easier. This system had to be replaced in the elevator circuit by plain spring feel because of particularly intractable problems.

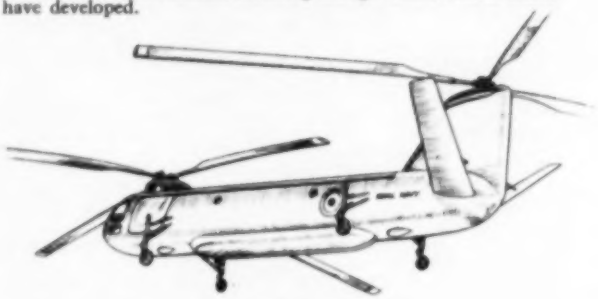
M. Jakimiuk, the designer, said that the Baroudeur could now stand on its own merits as an attack aircraft and was ready for service. This is his third post-war project, the other two being the Chipmunk and Beaver.

Another one of S.N.C.A.S.E.'s many undertakings is the Aquilon, which is, in name and form, a gallicized Sea Venom. Several modifications are evident, principally in the fuselage. The whole canopy slides back, driven by an electric motor which can be controlled by push-buttons on the outside of the nose. S.N.C.A.S.O. ejector seats have been fitted, staggered slightly backwards and considerably downwards. It is understood that the radar is of recent American pattern though the presence of a gun-sight indicates absence of "lock-on." The armament is unchanged. The aircraft can be operated as a single-seater in which condition the radar provides only gun-ranging.

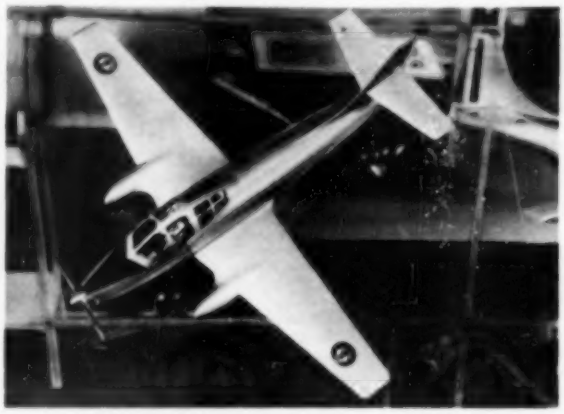
Both prototype Leduc 021s were at the show, and both were flown in on top of their Languedoc carriers. This is quite a feat, since the carrier must approach at more than the Leduc's stalling speed and the extra weight makes a gentle touch-down mandatory. The carriers' undercarriages have been strengthened but the tyres are unaltered. Any trouble here would be tricky. The launching is also a precise operation, since the tail-steady is released first and then both pilots fly themselves and each other. Gauges on each main mount indicate lift or weight forces to the carrier pilot and these he must balance out with his ailerons. The separation at 1,200ft on Saturday was a real achievement and the public was most lucky to be treated to such a sight. Incidentally, carefully framed on the port control console of one of the 021s are two little medallions, one to St. Theresa and the other to St. Christopher.

In the static display, Martin Baker were showing a near-final version of what they hold to be the ejector seat to end all ejector seats. By this they mean that the whole question has now been reduced to a point from which further development would be superfluous. They claim fully automatic operation (and this includes automatic explosive hood jettisoning) at all heights down to the ground with 87ft/sec ejection velocity, face blind, leg restraint, head rest and very low seat weight. The latest harness is intended to be "fitted to a pilot when he joins up." Thereafter, the straps would be sewn, and the whole, complete with leg garters, made into an integral part of his flying suit. To strap in, he would have two short webs emerging behind his shoulders, and these would be looped through shackles on the seat and fastened to the lap strap, which is also part of the seat. There is, therefore, only one junction box to fasten.

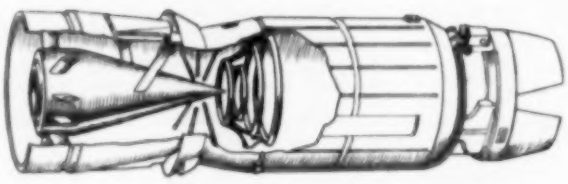
S.N.C.A.S.O., on the other hand, bought the M.B. non-automatic equipment licence and incorporated it in their own seat. This, and a lightweight derivative, have been modified to the American type of automaticity, which differs to some extent from the continuous mechanical actuating linkage which Martin Baker have developed.



Bristol 191 anti-submarine helicopter.



Model of Bréguet 1050 anti-submarine aircraft.



S.N.E.C.M.A. tailpipe for Atar turbojet, with afterburner.

A Spanish visitor—the A.I.S.A. I-11B.

STANDS at the SALON

New Components and Accessories seen at Le Bourget

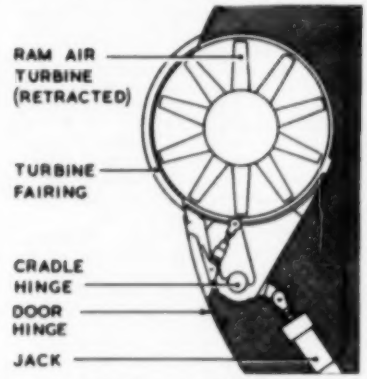
MANY of the British developments exhibited at the Paris show were described in our issue of June 10th; but a number of foreign exhibits, and some further British items, remain to be considered, and these are listed below in alphabetical order of manufacturer.

A.I.A. The Italian stand of Associazione Impresa Aeronautiche was partly occupied by Italjet, a firm anxious to establish itself in the design, development and mass-production of all forms of rocket motor. It has the backing of three associate companies: Whitehead - Moto Fides, Stacchini, and (by far the most important) the American company Aerojet-General.

Actual exhibits by Italjet included standard JATO units of American design—in particular the 14AS-1000 solid-propellant unit which has been made by the thousand in America—and various free-flight vehicles, including a 6ft test rocket by Whitehead, a Stacchini bi-propellant rocket missile and a small spin-stabilized weapon of 2¼in calibre.

A.S.T. Exhibited in model form was a new high-speed target for air-to-air practice (the model showed a standard Hunter as tug). The target, which is considered to be one of the best in the world for really high-speed towing, is a development of the C.4 first shown at Farnborough in 1953. Compared with the C.4, the new target has a reduced span, the wing being a true delta without untapered wing-portions outboard; the fins are also somewhat closer together.

Bendix. The various divisions of this large American corporation had much that was new to show. Particularly finely engineered were the various air-turbine-driven accessories, of the type for which there is now a great demand for military aircraft. As a typical example, the 34E10-1 afterburner-fuel pump may be cited; this has a two-stage turbine drive (pressure, 48 lb/sq in inlet and 14.7 exhaust; inlet at 500 deg F), a centrifugal pump delivering up to 30,000 lb/hr at 600 lb/sq in delivery, and an auxiliary drain impeller. The unit has a number of good features, such as



A typical installation for a Rotol air-turbine drive. Such units can be hydraulically extended into the air-stream and, at speeds approaching Mach 1, can reach full speed in a second or so.

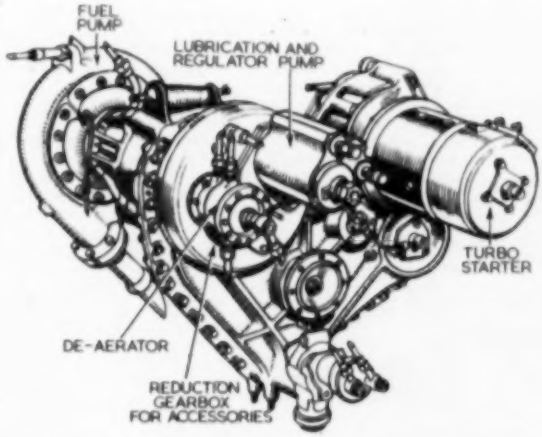
grease-packed, fuel-cooled bearings, and the total weight is 26 lb.

Another, smaller, air-driven pump is Type 866922, used for pumping dry air to provide a source of vacuum or oil-free air pressure. Typical applications include noxious-gas detection, or tank, ignition or radar-harness pressurization; the specification includes inlet and outlet pump pressures of 26 and 30in of Hg abs., an air flow of 0.15 lb/min (2 cu ft/min) with a turbine flow of 2 lb/min at 8 to 100 lb/sq in gauge at rated 10,000 r.p.m., and a total weight of 4.4 lb.

Dowty. Two small but important products from the Group are the three-position magnetic indicator and the Seloc range of lock-seal washers. The latter comprise, in effect, a star-type lock washer around which is moulded a synthetic-rubber sheath. When used under a nut or bolt-head, the tangs of the washer pierce the rubber and effect a secure lock; at the same time, the synthetic rubber seals the hole. The rubber specification of the standard Seloc range is proof against water, mineral-base oils and alkalis.

The three-position indicators are neat 2.2 oz units giving a display some ¾in-square. Each indicator can be energized to provide any of three separate indications (each of which can take the form of any pattern, in any colours) corresponding to "off," "on-1" and "on-2."

Fiat. Some indication of the scale of the Turin company's gas-turbine products was manifest by the display of the complete



Shown publicly for the first time at the Salon was the 200 h.p. accessory box for the Leduc 022 supersonic ramjet aircraft. The shaft-power will be derived from an Atar turbojet mounted in the centre of the duct.

rotating assemblies—compressor, turbine and coupling shaft—for the de Havilland Ghost 48 Mk 1, the Allison J35 and the General Electric J47. The two last-named (both American axial turbojets) are not wholly made in Italy, but Fiat have large contracts to make parts and carry out overhaul. The Ghost is, in fact, made wholly in Italy, and is supplied to Sud-Est for installation in the Sea Venom (Aquilon).

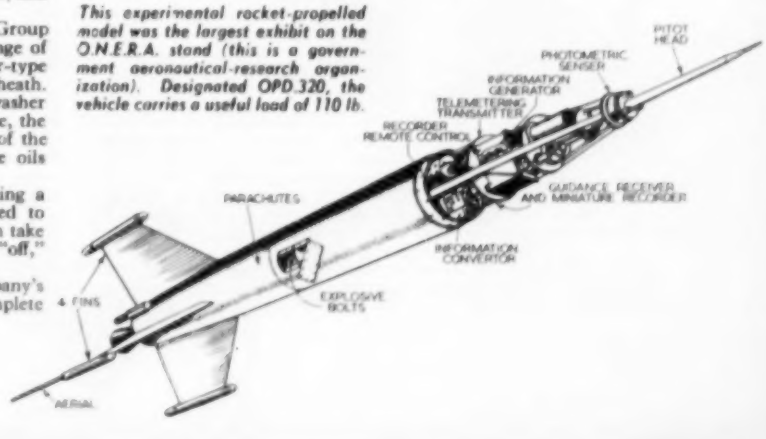
Gebecoma. Otherwise known as the Groupement Belge des Constructeurs de Materiel Aeronautique, this organization had a stand dominated by a Hunter port wing, of wholly Belgian manufacture, bearing Belgian camouflage and roundel, and the serial "ID6." Sabca, Fairey and other firms are taking part in Hunter production (in addition to work by Fokker and other Dutch companies, and the complete manufacture of Avons by the Fabrique National). F.N. had a part of the Gebecoma stand, filled with parts of Rolls-Royce centrifugal turbojets; production of these is on a small scale, for Fokker S.14s, the main bulk of Derwents now having been completed (to a four-figure total).

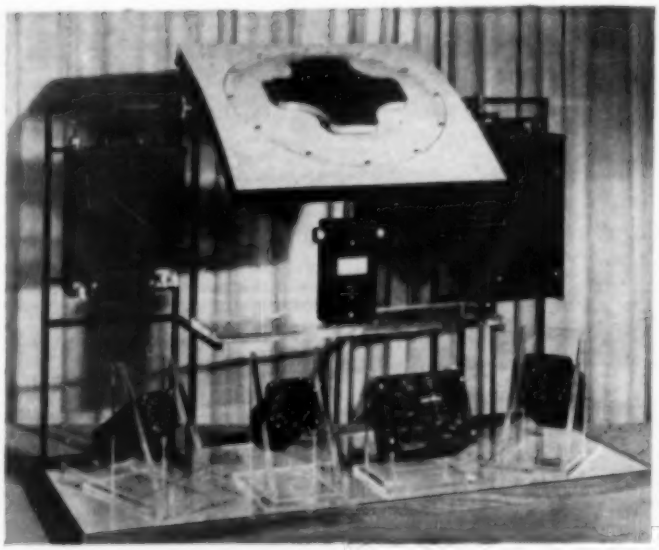
Gebecoma also exhibited a centre-fuselage structure for an S.R.7B Monitor (Farman design), a tandem trainer built under licence by Stampe-et-Renard. There was also to be seen a great array of Dowty hydraulic components, licence-built by Sabca.

Hispano Suiza. Reference to p. 384 of our issue of March 25th of this year will make clear the extent to which this group—mainly renowned for their turbojet production—make undercarriage units. In addition to the complete landing gears for the Vautour and Magister (illustrated in the issue referred to) Hispano showed a main bogie for the Caravelle jet transport. Although similar in conception to that of the Comet 2, the detail geometry of the whole unit has been changed. Wheel, tyre and brake sizes are, however, those of early Comets.

International G.E. In addition to the J47 turbojet mentioned

This experimental rocket-propelled model was the largest exhibit on the O.N.E.R.A. stand (this is a government aeronautical-research organization). Designated OPD.320, the vehicle carries a useful load of 110 lb.





Main units of the new Marconi subminiature automatic direction finder (radio compass) Type AD.722. The operation of the shallow, fixed, aerial (upper centre) is described in the text.

STANDS AT THE SALON . . .

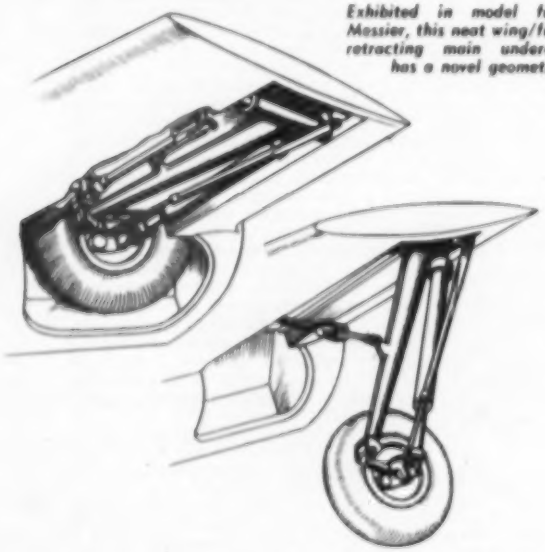
last week, the General Electric (U.S.A.) exhibits included some outstanding accessory items. One such was the Type 7T-AP-11 pump which supplies fuel to the J47-GE-17 and GE-33 afterburning turbojets. This incorporates three separate pumps in one unit, all driven off the same shaft by a bleed-air turbine. The three pumps have entirely different characteristics, so that the output/r.p.m. curves match to provide the optimum supply of fuel at any given engine condition. The maximum delivery is 71 gal/min in the afterburning regime, and control is maintained by a servo-mechanism incorporated in the pump. It is considered that this pump, which is mounted on the base of a fuel tank, is 25½ lb lighter than any comparable unit with separate impellers.

Kleber-Colombes. Technical associates of the Goodrich company, this company is one of the biggest tyre-manufacturers on the Continent. New developments included dimpled treads for DC-6 tyres (the dimples being deeper than those of British tyres, and of hemi-spherical instead of hemi-elliptical form), advanced tyres of the "Sferic" type, for applications demanding high inflation pressure and rotational speed, and tubeless tyres. Of the latter, the main exhibit was a circumferentially-ribbed tyre (730 × 190—16 mm) inflated to 49.7 lb/sq in, one application being the Dassault M.D. 550 delta.

Another new product is a pulsating-rubber de-icer boot, the first to be made in France, which is now in production for such machines as Air France L.1049s. These boots are very greatly in advance of previous pulsating installations, and the basic type has, in fact, actually been operated at a Mach number of 1.2 while installed on a U.S.A.F. fighter. Flying characteristics are reported to have been unchanged.

Leduc. On this stand was the wing skin for the forthcoming Leduc 022 supersonic fighter. Machined from thick alloy plates joined together by spanwise rows of bolts, this wing is integrally stiffened and forms a fuel tank, anti-sloshing valves being situated around the few ribs. The complete accessory assembly for this advanced ramjet machine was also of interest. The centrifugal fuel pump had a quoted maximum delivery of no less than 4.4 gal/sec at 569 lb/sq in, the unit weighing 37.5 lb.

Exhibited in model form by Messier, this neat wing/fuselage-retracting main undercarriage has a novel geometry.



Marconi. Here was to be seen the outstanding sub-miniature radio compass, Type AD.722, which was released from security restrictions just before the Salon. Believed to be the smallest and lightest (total weight of main components about 20 lb) equipment of its type, the AD.722 employs a fixed aerial in the form of a sealed iron-cored crossed loop less than ¾in high; thus, full suppression is not necessary for low drag, or, if full recession is mandatory, only a small hole need be cut.

The Bellini-Tosi system is employed, the galvanometer being embodied in the bearing indicator. Two sizes of indicator are available, and signals may also be fed into an existing bearing indicator if the latter is of suitable pattern. The range of frequencies is 200/1,700 kc/s, and 28 V D.C. supply can be used directly for H.T.

Messier. New undercarriages displayed included those for the Nord 1402 Gerfaut (in 195 kg/sq mm—277,350 lb/sq in—steel), the main and nose units of the S.O. 9050 Trident-development (tyres, 26 × 7.75—15 and 6.50 × 5½) and for the forthcoming Nord 1500 intercepter (tyres, 750 mm × 250 mm and 14 mm × 05 mm). Multi-disc brakes of advanced patterns were in evidence, and demonstration models showed the retraction of a four-wheel bogie into a wing and a single-wheel main leg into a wing/fuselage bay.

Rotax. Apart from the appearance of a compressed-air starter for gas turbine engines, the major new items by Rotax included a combined generator/alternator set weighing 40 lb with the following output: D.C., 30 V, 100 amp continuous from 6,000 to 10,000 r.p.m.; alternator, 115 V, 3.65 amp continuous at 0.85 p.f. from 6,700 to 10,000 r.p.m. between frequency limits of 335 and 500 cyc/sec. Another new product was the NB.31 high-energy ignition unit, weighing just over 4 lb, which has an outstanding performance for high-altitude re-lighting. The box can work between −40 and +100 deg C at altitudes up to 60,000ft, and can provide a minimum of 180 sparks per minute at 20 V input, with a stored energy of 6 joules at 2 kV.

Rotol. Illustrated here is a typical installation of the ram-air turbine manufactured by Rotol under AiResearch licence. There is now at least one production application for such a unit, and it will probably be employed to drive a hydraulic pump to serve powered flying controls. Such devices have long been used in powered-control machines of the U.S.A.F. and Navy.

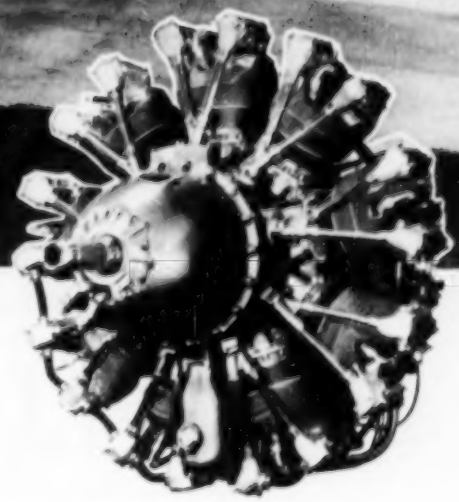
S.N.C.A.S.O. The "background" developments of this National group are outstanding. Particularly noteworthy work has been done in the fields of methods of construction (including, *inter alia*, honeycomb sandwiches and reinforced plastics), the use of 400-cycle A.C. power systems, ejection seats and other safety equipment, and the production of strong glass canopies.

S.N.E.C.M.A. Briefly mentioned last week, the reverse-thrust *déviateur de jet* (now licensed by Bristol) is looked upon as a fully developed article, and series production is already under way. Over 225 are already being assembled for use on the Atar D turbojets of the Mystère IICs of the Armee de l'Air and Israel (and any other nation which may buy the Mystère), and development of later units—presumably for the Vesta and Vulcain—is going ahead. With the Atar D, 50 per cent reverse thrust is claimed.

Henry Wiggin. The basic theme of this company's stand was the internationality of the Nimonic-Inconel family of nickel-base alloys, with particular reference to items made in France. One of the most unusual of the latter was a heat shield mounted inside the actual ramjet duct of the Leduc 021. Made of Nimonic 75 sheet, it does duty as a combustion-chamber liner, and has to withstand considerable gas loading at high temperature.

Other Wiggin exhibits included Refrasil and Thermoflex blankets, tailored to fit jet-pipes and comprising two thin sheets of Inconel sandwiching a temperature-resistant fibre (a silica fibre in the case of the Delaney-Gallay-manufactured Thermoflex, resulting in a weight of 0.47 lb/sq ft for a half-inch thickness giving a 50 per cent drop in temperature).

Jack of all Trades



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ALVIS LEONIDES

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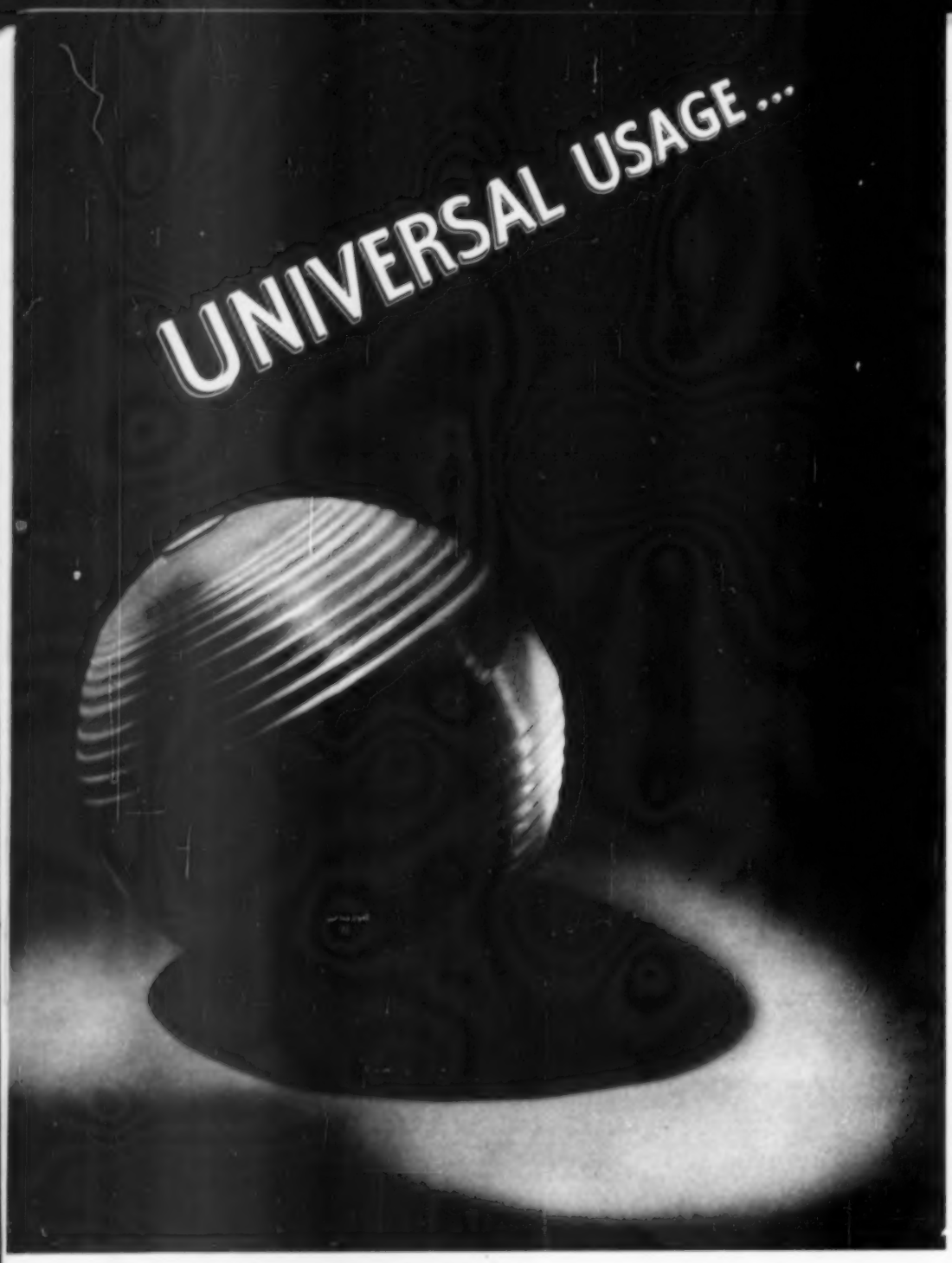

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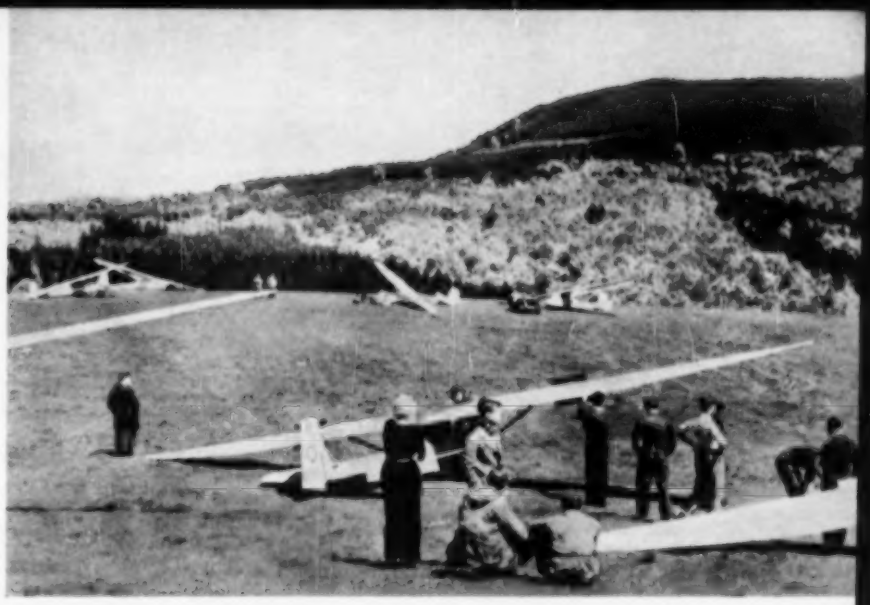
The 1955 2nd T.A.F. Gliding Contests:

An Outstanding Meeting



A general view of the launching point during the championships.

Scharfoldendorf Championships

ONCE again, for an all-too-short period, *der romantischer Ith* regained something of its former glory when the Association of 2nd T.A.F. Gliding Clubs recently held their annual competitions at Scharfoldendorf, the magnificent ridge site, and former Mecca of so many Service enthusiasts, not far from the Pied Piper's Hameln.

Clubs assembled on Monday, May 23rd, with high hopes, after a week of violent atmospheric instability over the whole of the British Zone. The Hameln club were unfortunate enough to overturn their Meise trailer on the treacherous wet cobblestones *en route*, damaging the aircraft just sufficiently to keep it out of the contest. The following morning the site (1,140ft a.m.s.l.) was in cloud and the day was given over to committee meetings and clubs' final preparations. Wednesday was devoted to two-seat Kranich checks for the many people who, used only to flat airfield sites, had never flown at Scharfoldendorf before. Once the morning hill-fog had cleared, the ridge of high pressure over the Zone gave us a fine day, and we watched a jet-stream's N.W.-S.E. cloud system lazily moving south from one horizon to the other.

The next two days were set aside for club practice-flying: there were a number of quite long thermal flights and several practice away landings in the valley. Flying had to cease before lunch on the second day as the anti-cyclone to the north collapsed and a trough moved in, giving continuous rain and a very low cloudbase for the rest of the day. Saturday was no better; a warm occlusion almost stationary over the site kept us in cloud all day.

As in previous years aircraft were entered in three classes: A, for any type; B, all except Weihes and Rhonsperbers; and C, Grunaus only. Class C pilots had to have less than fifty hours flying and gliding and were not to be qualified Service power pilots. Clubs could enter up to six aircraft, of any class, but a full team comprised one aircraft from each class.

Eight clubs entered, but for various reasons (including serious retrieving vehicle problems and Hameln's Meise withdrawal) several combined to field complete teams, which they would not otherwise have been able to do. Thus Gutersloh and Hameln became "Hamersloh", and Wahn, Sylt and the new H.Q. Club at Wildenrath became "Wasylwild".

The competitions began on Whit Sunday, May 29th, in anticyclonic conditions which persisted for the next two days, together with a moderate lapse-rate. This year we operated from the old "long launch" site only, and no more perfect setting for gliding can be imagined. A huge meadow thickly carpeted with cowslips and purple ladysmock, it is set on top of the twelve-mile limestone ridge clothed in beech forest, with similar foothills of the Harz Mountains rolling away on all sides.

The task for all classes was an out and return race to the Army Club's site just north of Hameln, 30 km away. Providing the qualifying distance of 20 km was completed, points were awarded for distance, speed, reaching goal and returning to launching site. The highest scorer in each class was then given 1,000 points and the others scaled down in proportion.

In Class B, F/O. Dave Brett in Brüggen's Minimoa just failed by half a kilometre to qualify, and F/O. John Boyle (Geilenkirchen Meise) fell a little further short. All the Grunaus in classes B and C were scattered within five or six kilometres. In class A four aircraft got away, almost together. After a bitter struggle against a 90-deg crosswind which very soon became an almost direct headwind of 10-15 kt all reached the goal, Capt. Whittington-Jones in Hamersloh's Minimoa landing there just after 5 p.m. F/O. Salmond in Brüggen's Meise was the first back, managing to scrape in only because for the last two miles the ridge crest sloped gradually down at roughly the same angle as his minimum sink glide-path. Sgt. Rip Kirby arrived nine minutes later in Geilenkirchen's Weihe. F/O. Derek Ellis was not far behind but unfortunately had to land Oldenburg's Weihe opposite the site in the valley. All had done the second lap at an average speed of 60 km/hr, but over the whole flight Sgt. Kirby (2 hr 14 min) won with an average speed of 27 km/hr.

On this and other days, observers were stationed at turning-points. They changed sheet signals every half-hour and kept a look-out for aircraft. Pilots had to orbit the point three times and, on landing, had to report the exact time and signal displayed. On the whole this system worked very well.

The next day, Whit Monday, there were again great crowds of German enthusiasts taking a very lively interest in the proceedings. They included members from two of the four local German clubs who now control the site and, with their two Grunau Babies, pod-and-boom Cumulus and two-seat Rhonlerche—all brand-new and largely built by themselves—they shared launches with us. The surface wind was light and variable, but generally easterly.

The class A task was to fly as many circuits as possible of a "Silver C" 57½-km triangle, with legs roughly N.N.E., E. and S.S.W. F/L. John Brownlow in Gutersloh's Minimoa and Sgt. Bill Cumpston in Oldenburg's Weihe were forced to land on reaching the second turning point after three hours. Sgt. Kirby in Geilenkirchen's Weihe landed back at the site with cramp, having flown two circuits in just under four hours, and so when F/L. Phil Fabesch arrived overhead in Brüggen's Meise with plenty of height in hand after three circuits in just under six hours, he was called in by radio to save a pointless retrieve.

The class B task was a free goal flight, with points also for gain of height. Everyone went downwind, more or less S.W. Cpl. Woodman in Oldenburg's Meise won, overflying his goal 65 km away near Kassel by 3 km. Everyone else had been too greedy, and no others landed near their goals. Sgt. Rex Minter in Geilenkirchen's Meise went 62 km, halfway to his goal at the Mohne Dam.

Class C Grunaus had an endurance task, landing back on the site with one point per minute airborne after half an hour. S. A/C. Merral (Geilenkirchen) did a most creditable 5 hr 19 min having been on the approach at 4½ hr! F/L. Abbott (Brüggen) was next with 3 hr 50 min.

The next day, the 31st, the second "A class" pilots attempted the triangle. F/O. Salmond (Brüggen Meise) got a strong thermal off the first launch of the day. He arrived at the first two turning points before the observers but managed to establish his claim by radioing back the numbers of Friesian cows and of trees in an orchard. After being saved on the third leg at nought feet by a sniff from a quarry, he went on to complete two circuits and two legs in 5 hr 24 min. Sgt Kirby landed Geilenkirchen's Weihe at base after one circuit, but then went on to do another round and two legs, and so tied for first place. F/O. Derek Ellis (Oldenburg Weihe) completed two circuits and one leg, missing his "Silver C" five-hour duration by one minute. These three were all forced down within ten minutes and two miles by the

SCHARFOLDENDORF CHAMPIONSHIPS...

downdraught from a passing cumulonimbus. Cpl. Williams (Wahn Meise) completed one leg, and Capt. Whittington-Jones was unlucky in damaging Hamersloh's Minimoa when he ran into a single-strand electric fence stretched across an innocent-looking field.

Endurance and height were the order of the day for B class. F/O. Brett (Brüggen Minimoa) with the second launch of the day also contacted that first thermal and won with 5 hr 51 min and a gain of 2,850 m, just missing his "Gold C" height. Cpl. Balchin (Oldenburg Rhonbussard) was next with 5 hr 22 min; then F/O. Boyle (Geilenkirchen Meise) 3 hr 50 min, Cpl. Greenall (Wahn Grunau) 4 hr 1 min and F/O. O'Hare (Hamersloh Grunau) 1hr 29 min.

Only two Grunaus qualified for the free-distance flight in Class C. Cpl. Howarth (Wahn) went well away 134 km to Lingelbach in 3 hr 5 min and Cpl. Dave Clewer (Brüggen) just missed his Silver distance with 46 km.

June 1st dawned rather bleak and unpromising, with the anti-cyclone slowly weakening, so it was decided to have a "make-and-mend" day. This decision was regretted later on when, for a while, an active wave system was observed overhead.

Thursday, June 2nd, brought back the anti-cyclonic conditions for another three days. Hamersloh decided to replace their Minimoa, temporarily out of action, by their Weihe.

There were some extremely free distances in Class A. The 10-15 kt N.E. wind took Sgt. Kirby (Geilenkirchen Weihe) 137 km in 2 hr 41 min to Niederklein near Marburg; Sgt. Bill Cumpston (Oldenburg Weihe) 148 km in 4 hr 15 min to Ebsdorf; F/Sgt. Walker (Wahn Meise) 217 km to just west of Frankfurt in 5 hr 39 min—a flight notable for its late take-off (1.46 p.m.) and landing (7.25 p.m.); and F/L. Fabesch (Brüggen Meise) 227 km in 6 hr 25 min to Rhein-Main Airport south of Frankfurt, where he was "batted-in" by a little yellow truck. He had travelled part of the way in company with a German Meise.

The second shift in Class B tried endurance and height. Cpl. Woodman (Oldenburg Meise) won with 5 hr 25 min. Then came Lt. Williams (Oldenburg Rhonbussard), 2 hr 25 min, and Capt. King (Hamersloh Grunau), 38 min.

In class C only one Grunau went farther than 20 km. This was Brüggen's accountant officer, F/L. Archie Abbott who, with a total of 17 hours gliding to his credit, literally sweated out 167 km and 5 hr 3 min to Herbornseelbach, a small village near Giessen. He landed then only because he was uncomfortable and mistakenly believed he was well over his five hours. This flight is believed to be a 2nd T.A.F. record for Grunaus.

Oldenburg had trailer trouble and their Weihe did not return till 6 p.m. the next day, June 3rd, and so was unable to complete in the free goal task, under similar weather conditions. Sgt. Kirby (Geilenkirchen Weihe) again won with a 213 km flight to his goal at Wahn airfield just south of Cologne. He wasn't under arrest for very long once it was realized that a glider couldn't very well give way to a formation fly-past, even though it was for the A.O.C.'s annual inspection. Brüggen's Meise was the only other A class machine to get away, though its pilot, F/O. Salmond, was forced to land after flying only 87 km to just south of Kassel.

F/O. Brett (Brüggen Minimoa) avoided the dead ground around Kassel by going round farther to the east and survived a dampening alto-stratus patch to reach Rhein-Main, where he too was "batted-in." Air Traffic asked that any other Brüggen aircraft should first file a flight plan, and promised to listen out for them on the R/T. The crew clipped the Meise's 35 minutes the day before, arriving only ten minutes after touchdown. Cpl. Bill Greenall (Wildenrath) and F/O. O'Hare (Hamersloh) also did very well by going 145 km to Werne and 103 km to near Medebach respectively in Grunaus. F/O. Boyle (Geilenkirchen Meise) flew 57 km to near Bad Lippspringe and Cpl. Balchin (Oldenburg Rhonbussard) 38 km to near Brakel.

The second C-class shift flew an endurance task. By landing in the valley after 2 hr 18 min Cpl. Howarth sacrificed a commanding lead to Sgt. Hensby (Geilenkirchen), 1 hr 21 min, and Cpl. Clewer (Brüggen), 1 hr 19 min.

On Saturday, June 4th, there was a race north-west to Buckeburg Airfield, a distance of 54 km. Surface wind was N.N.E./5-10 knots. In Class A, F/L. Fabesch shot in first at 135 km/hr, Brüggen Meise's limiting speed, after 1 hr 9 min, an average speed of 46 km/hr. F/Sgt. Walker (Wahn Meise) arrived after 1 hr 37 min (32 km/hr), and Sgt Bill Cumpston (Oldenburg Weihe) landed just 100 yards short of the airfield.

Sgt. Jim Blundell (Brüggen Minimoa) had not quite enough height to scrape over the final ridge, but got his 1,000 points with 44 km to Westerdof. Capt. Simon King (Hamersloh Grunau) achieved 23 km. In Class C, S.A/C. Merrall (Geilenkirchen) won with just over 20 km.

Sunday was devoted to further essential instructor training in the Kranichs. The competition picture was by then quite clear with Brüggen well in the lead, and winning for the second year in succession. However, there were ties for first places in both

Practice day in the valley: F/L. Abbott's first away-from-base landing, in the Grunau which he flew in Class C.

A and B classes, and so on Monday a fly-off was held to decide these. A goal flight to Kassel airfield (74 km) was eventually chosen, with points for height to count if both contestants arrived. Forgetting to switch on their barographs, F/Lt Fabesch and Sgt. Kirby both had to land, the latter leaving lift of 4 m/sec. Brett waited for Fabesch to climb up again and then Minimoa and Meise set off together, about a mile apart, desperately sniffing for the all-too-sparse lift in the rapidly over-clouding sky, and calling each other over by radio when some was found. In this manner Fabesch just scraped in to the airfield, whilst Brett fell short by only 7 km. Sgt. Kirby and Cpl. Woodman (Oldenburg Meise) both got away some time later, but conditions had deteriorated by then. Sgt. Kirby did well to get within 19 km of the goal, landing near Hann Münden. Cpt. Woodman flew nearly halfway, to within 40 km at Northeim. Kranich flying continued.

Tuesday's wind direction (south) made flying impossible. On Wednesday, June 8th, Mrs. Pretty, wife of A.V-M. W. P. G. Pretty, C.B.E., Air Officer Admin. at H.Q. 2nd T.A.F., very kindly presented the prizes and then presided at the celebration luncheon. The retiring chairman, A. Cdre. G. B. M. Rhind, spoke of the serious financial and equipment problems still facing the Association. Incidentally, the reason 2nd T.A.F. is not entering a team in the U.K. Nationals is that of cost. The money is quite rightly considered to be better spent keeping the sport alive in 2nd T.A.F. for the airmen for whom it is chiefly intended, especially when finances are so precarious.

Operational Notes. The most interesting aspect of the competitions was Brüggen's pioneering use of radio. The best position for the 8ft aerial had been found to be under the keel, stretched between the main and tail-skids. No damage was ever caused to it by landings on grass or ploughed fields. Similar aerials were mounted horizontally on the roof of each retrieving vehicle, which also carried 10ft vertical folding aerials for extreme-range work. If contact between aircraft and retrieving crews was temporarily lost, touch could often be maintained *via* Base Ops, who—with an identical set—monitored all channels and received progress reports. Each crew-chief kept a log, in which he noted times and heights reported by his pilot on entering and leaving thermals. The average rate of climb was then passed back to the pilot, who then used his optimum cross-country speed chart.

Conclusion. The variety and interest of tasks and the ideal weather combined to make the 1955 competitions undoubtedly the most successful of recent years. Some idea of conditions can be gained from the fact that 53 "Silver C" heights, 26 distances and 11 durations were flown, and five "Silver Cs" were completed. There were 393 competition launches, giving 238 hr 2 min, and over the whole period, a total of 667 launches, giving 289 hr 59 min.

J.S.R.S.

RESULTS

Challenge Shield, R.A.F. Brüggen; **Class "A" Trophy,** F/L. J. P. Fabesch (Brüggen); **Runner-up, Class "A",** Sgt. G. Kirby (Geilenkirchen); **Class "B" Trophy,** F/O. D. E. Brett (Brüggen); **Runner-up, Class "B",** Cpl. B. J. Woodman (Oldenburg); **Class "C" Trophy,** S.A/C. K. Merrall (Geilenkirchen); **Runner-up, Class "C",** F/L. J. A. Abbott (Brüggen).

"Most Outstanding Performance" Prize.—F/L. J. A. Abbott (Brüggen).

"Most Outstanding Performance" Class Prizes.—*Class "A"*, Sgt. G. Kirby (Geilenkirchen); *Class "B"*, Cpl. W. Greenall (Wildenrath); *Class "C"*, S.A/C. K. Merrall (Geilenkirchen).

Gliding Efficiency Trophy.—R.A.F., Oldenburg.

Team Scores.—R.A.F., Brüggen, 11,382 points; Geilenkirchen, 8,857; Oldenburg, 5,425; "Wasylwill" (Wahn, Sylt, Wiklendrath), 4,451; "Hamersloh" (R.A.F. Gutersloh and R.E., Hameln), 1,853.

Averages (Class "A").—F/L. J. P. Fabesch (Brüggen), 1,000 points; Sgt. G. Kirby (Geilenkirchen), 1,000; F/O. J. S. R. Salmond (Brüggen), 677.

Averages (Class "B").—F/O. D. E. Brett (Brüggen), 667 points; Cpl. B. J. Woodman (Oldenburg), 667; Sgt. J. H. Blundell (Brüggen), 451.

N.B.—1st and 2nd positions in both Class "A" and Class "B" were decided by a special contest held on June 6th—a goal flight to Kassel.

Averages (Class "C").—S.A/C. K. Merrall (Geilenkirchen), 667 points; F/L. J. A. Abbott (Brüggen), 564; Cpl. D. M. Clewer (Brüggen), 435.

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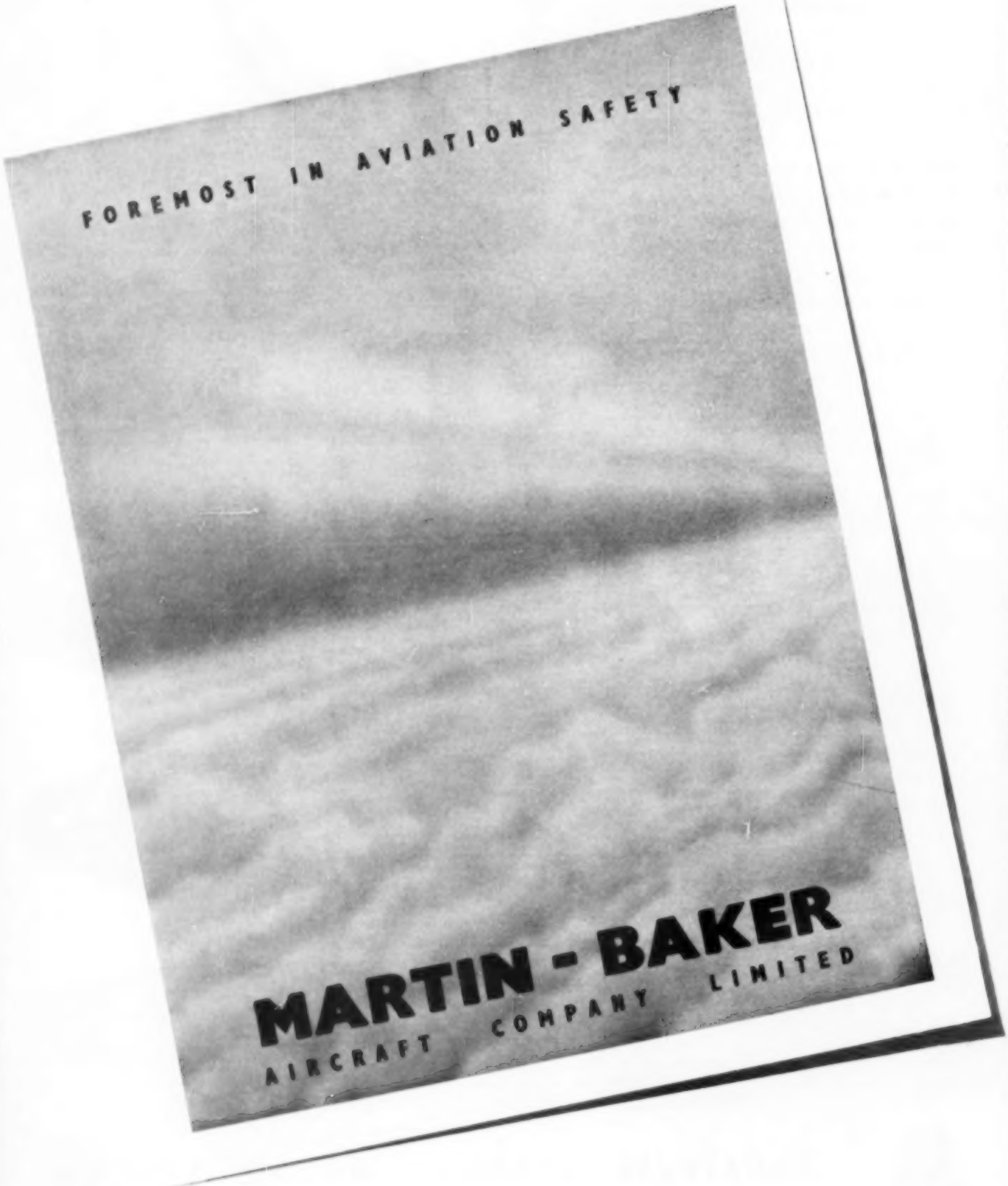
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THE TURBOPROP in PRACTICE

B.E.A.'s Viscount Experience: Mr. Masefield's Paper at the Anglo-American Conference

From Los Angeles, June 20th

PRIDE of place in the delivery of papers at the fifth Joint Conference of the Institute of the Aeronautical Sciences and the Royal Aeronautical Society in Los Angeles was accorded to Mr. Peter G. Masefield, chief executive of British European Airways. His title for Paper 1, read on the morning of Monday last, June 20th, was *Operating Experience with Turboprop Aircraft*.

Mr. Masefield analysed B.E.A.'s commercial experience of nearly a quarter of a million Dart flying hours, since the Corporation flew its first commercial Viscount service (with the V.630 prototype) five years ago. The flight took place on July 29th, 1950, between London and Paris. B.E.A. has now operated 57,000 aircraft hours and 11½ million aircraft miles of airline services with Viscount V.701s, during which some 570,000 passengers have been carried and a net profit of nearly $3 million has been earned.

Looking ahead, Mr. Masefield stated his belief in the economic superiority of the turboprop vehicle, though he saw a place also for the turbojet in specific "blue-riband" operations for the future. Finally, he declared his belief that the performance of the Bristol Britannia long-range turboprop airliner would bring it prominently into the world market as a worthy colleague of the Viscount—essentially a medium-range aeroplane.

The lecturer introduced his paper (abstracts from which follow) by recalling that on July 29th, 1950, B.E.A. operated the world's first scheduled commercial passenger air service with a turbine powered aeroplane—the Vickers Viscount V.630 32-passenger prototype. On that summer morning it flew the 237 miles between Northolt Airport, London, and Le Bourget Airport, Paris, in 57 minutes from take-off to touch-down, carrying a payload of 6,765 lb, including 22 passengers, among them Sir Frank Whittle and Mr. George R. Edwards.

Significantly, a week later—on 3rd August, 1950—a contract was signed between B.E.A. and Vickers-Armstrongs, Ltd., for the production of a fleet of 26 developed Viscount V.701 47-passenger aircraft, each powered with four 1,547 e.h.p. Rolls-Royce Dart 505 turboprops. The first V.701 was delivered to B.E.A. on January 3rd, 1953, 29 months from the signing of the initial contract.

Since then, and up to June 1st, 1955 [continued the lecturer] B.E.A. has flown a total of 57,000 aircraft hours and 225,000 engine hours with Rolls-Royce Dart turboprops installed in 30 individual aircraft. Details of this flying, in five basically different types of aircraft, are set out in Table I.

Operating Results. Detailed statistics for the 25½ months of scheduled commercial passenger services, from April 19th, 1953, to May 31st, 1955, are set out in Table II.

During this initial period of airline service the longest regular sector operated by the Viscount on B.E.A. routes has been London to Gibraltar—1,086 statute miles non-stop—scheduled to take a block time of 4 hr 20 min. The shortest regular sector operated has been Manchester to Birmingham, 65 statute miles, scheduled to take a block time of 35 minutes.

Over all routes the Viscount has materially improved B.E.A.'s competitive position and has dramatically increased the ratio of traffic carried by B.E.A. against such excellent aircraft as the DC-6B and Convair operated by rival airlines. Between London and Geneva (487 statute miles), during the first year of Viscount operations, B.E.A.'s share of the total air traffic went up from 35 per cent to 50 per cent, while between London and Stockholm (938 statute miles) its share of the total went up from 32 per cent to 52 per cent. This experience has been shared by other Viscount operators.

The original B.E.A. V.701 Viscounts with Dart 505 engines are now being converted into V.701As with Dart 506 engines, and a gross weight increased from 57,000 lb to 60,000 lb. Experience of operating the V.701A with Dart 506 engines at a maximum gross weight of 60,000 lb, has shown that its maximum

TABLE II: VISCOUNT V.701 OPERATING AND TRAFFIC STATISTICS IN B.E.A. SERVICE

On Revenue-earning Operations, April 19th, 1953, to May 31st, 1955.

Operating:—	
Average no. of aircraft	17.1
Revenue hours flown	51,430
Average daily utilization (hr)	3.06
No. of flights	23,436
Aircraft miles flown	11,466,433
Average length of flight (stat. miles)	490
Average block speed achieved (m.p.h.)	223
Traffic:—	
Passengers carried	568,285
Passenger-miles flown	342,802,746
Seat-miles available	497,809,616
Passenger load-factor (per cent)	68.8
Capacity ton-miles	58,231,923
Load ton-miles	38,924,650
Total revenue load-factor (per cent)	66.8
Financial:—	
Revenue	$29,797,908
Expenditure	$27,008,764
Net profit	$2,789,144
Derivatives:—	
Cost per flying hour	$525.56
Cost per aircraft mile	$2.36
Cost per C.T.M.	46.32c.
Cost per seat-mile	5.43c.
Revenue per flying hour	$579.88
Revenue per aircraft mile	$2.60
Revenue per C.T.M.	51.10c.
Revenue per seat-mile	5.99c.
Profit per flying hour	$54.32
Profit per aircraft mile	$0.24
Profit per C.T.M.	4.78c.
Profit per seat-mile	0.56c.
Load-factor required to break even on aircraft (direct) costs (per cent)	34.5
Total load-factor required to break even on total costs (per cent)	60.4

TABLE I: B.E.A. TURBOPROP OPERATIONS (JANUARY 1950 to JUNE 1955)

Date	Aircraft type	Engines	Operation	Where operated	Aircraft hours	Cumulative aircraft hours	Engine hours	Cumulative engine hours
(1) Jan. and Feb. 1950	Viscount V.630 (G-AHRF)	Dart R.Da.4 (1,250 s.h.p.)	Training and proving	Northolt	9	9	36	36
(2) July 29th, 1950, 1st service, to Aug. 23rd, 1950	Viscount V.630 (G-AHRF)	Dart (R.Da.4)	Passenger service	London-Paris London-Edinburgh	127	136	508	544
(3) June 9th, 1951, 1st B.E.A. flight	Dart-Dakota (C-47) (G-ALXN) (G-AMDB)	Dart (R.Da.3)	Training and development	London-Buckeburg London-Copenhagen-Milan, etc.	644	780	1,288	1,832
(4) Aug. 15th, 1951, 1st service	Dart-Dakota (C-47) (G-ALXN) (G-AMDB)	Dart (R.Da.3)	Freight services	From Northolt	1,256	2,036	2,512	4,344
(5) Aug. 21st, 1952, to Nov. 11th, 1952	Viscount V.700 (G-AMAV)	Dart (R.Da.3) 505	Training and proving flying	Based L.A.P.-Rome and all B.E.A. routes	249	2,285	996	5,349
(6) Oct. 5th, 1951, to Nov. 30th, 1951	Viscount V.700 (G-AMAV)	Dart (R.Da.3) 505	Hot weather trials	Khartoum and Nairobi	105	2,390	420	5,760
(7) From Jan. 3rd, 1953	Viscount V.701 (G-ALWE)	Dart (R.Da.3) 505	Training and development	London	780	3,170	3,120	8,880
(8) April 16th, 1953, to June 1st, 1955	Viscount V.701 (G-ALWE et seq.)	Dart (R.Da.3) 505 and 506	Airline service	Based London Airport	53,809	56,970	215,200	224,080
(9) From Oct. 8th, 1953, to Oct. 29th, 1953	Viscount V.700X (G-AMAV)	Dart 505 (Up-rated racing engines, 1,500 s.h.p.)	London to New Zealand Air Race	London-New Zealand	164 (inc. tour)	Total aircraft hours 57,134	656	Total engine hours 224,736

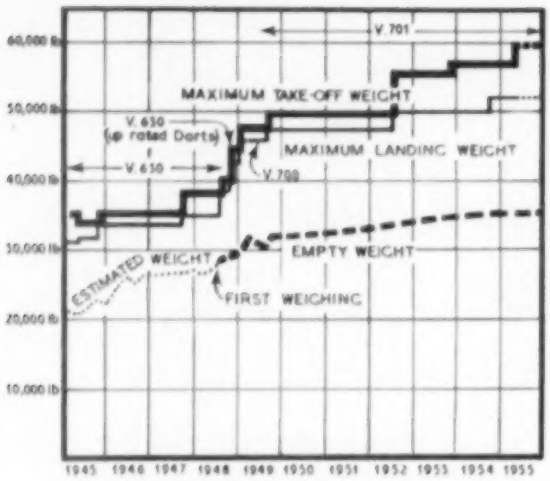


Fig. 1. History of Viscount weight, 1945-55.

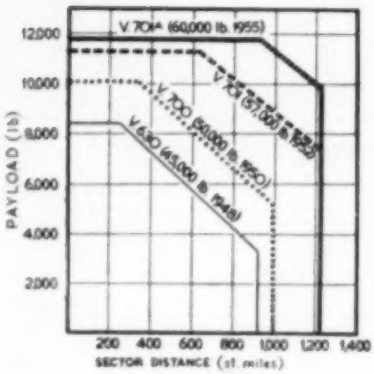


Fig. 2. Viscount payload development, 1948 to 1955 (right), and 1955 to 1958 (below).

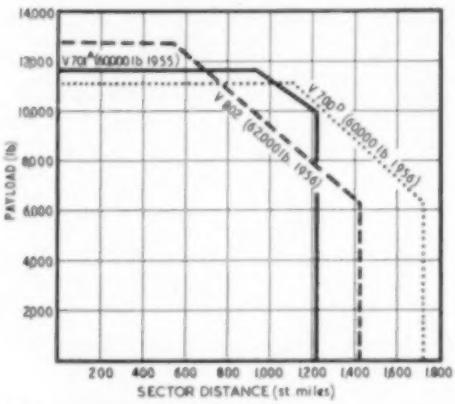
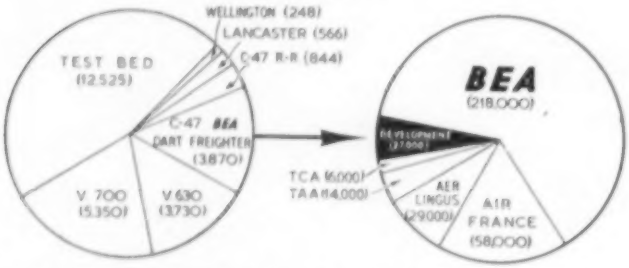


Fig. 3. Dart progress: left, 27,000 hours of engine development (July 1947-March 1953); right, 350,000 hours of airline operations (July 1947-June 1955).



THE TURBOPROP IN PRACTICE . . .

payload of 11,808 lb can be carried for a sector distance of 950 statute miles, with full airline fuel reserves and allowances. Its maximum sector distance with full tanks works out at 1,230 statute miles. Over this distance it can carry a payload of 9,858 lb, including 47 passengers, at a mean true air cruising speed of 321 m.p.h. at 21,500ft. For this, 940 e.h.p. is taken from each engine at 13,600 r.p.m. with a fuel consumption averaging 355 U.S. gal/hr. These developed V.701A aircraft are now in service with B.E.A. and show improved economics in comparison with the original V.701s at 57,000 lb a.u.w. Later production models go up to 62,000 lb.

A break-down of the operating costs of the Viscount V.701 in 51,500 hours of airline operation—including 47,000 take-offs and landings at a mean flight time of 2 hr 12 min—is set out in Table III. This shows that the total cost of engine and airscrew maintenance and overhaul—at $38.8 a flying hour—and 0.62 cents per take-off horsepower hour—has mounted to 13 per cent of the total aircraft (direct) costs during the first two years of the Viscounts' life with B.E.A. This figure has recently been substantially reduced after the initial "learning period," and the teething troubles inevitable with a new vehicle.

TABLE III: VISCOUNT V.701. B.E.A. AIRCRAFT ("A") (DIRECT) COSTS
April 19th, 1953-May 31st, 1955; 51,500 revenue flying hours (25¼ months).

Basic Annual Costs:—		$
Amortization (10-year life)		2,053,760
Interest (at 4½ per cent)		1,013,180
Insurance (at 2½ per cent)		658,613
Total basic annual costs	(for 25¼ months)	$4,525,553
	(per annum)	$2,127,000
Hourly Cruising Costs:—		
Flying staff		1,920,299
Stewards		314,681
Fuel and oil		3,590,790
Engineering direct labour: Engines		34,544
Propellers		1,870
Airframe, etc.		1,413,219
Materials: Engines		38,158
Propellers		—
Airframe, etc.		478,537
Outside contracts: Engines		1,608,351
Propellers		309,560
Airframe, etc.		575,383
Total hourly cruising costs	(for 25¼ months)	$10,285,392
	(per flying hour)	$199.8
Landing Costs:—		
Landing fees	(for 25¼ months)	$569,688
	(per landing)	$24.21
Summary:—		
Total aircraft ("A") costs	for 25¼ months	$15,380,633
Total revenue earned	for 25¼ months	$29,797,908
Revenue surplus on "A" costs	for 25¼ months	$14,417,295
Total aircraft costs per flying hour		$299.5
Total aircraft costs per revenue mile		$1.341

N.B.—These costs are representative of European prices and conditions. Costs under U.S. conditions appear to run some 30 per cent less.

The Dart.—By the time B.E.A. put its first V.701 into commercial service a total of 21,000 engine hours had been built up, of which 13,624 were in the air (3,800 of these early flying hours were accumulated in two Dart-Dakota airframes during 1951). These early airline hours with the DC-3 proved an invaluable contribution to later success. They made possible the elimination of early teething troubles, particularly on reduction gears and de-icing.

Since 1946 [Mr. Masefield's paper continued] the Dart has been steadily developed and it has now built up more than 350,000 hours of airline service, of which 225,000 have been with B.E.A. The engine has, in fact, advanced from the 1,000 h.p. of the original project to the 2,750 h.p. of future promise—all in the course of ten years (Fig. 4). A record of the various versions of the Dart during this time is set out in Table IV.

The heart of any aeroplane is its engines; its performance, its reliability, its operating cost and its passenger appeal stem fundamentally from the characteristics of its power units. In the Dart we have an engine which is offering in the Viscount a relatively high performance combined with excellent maintenance characteristics, good economy and great passenger-appeal. Although the Dart remains, in conception, a 1945 engine—significantly inferior to what could be achieved from a new approach today—it now has the unique attraction of combining the fundamental virtues of a turboprop with a background wealth of airline operating experience. Naturally there have been teething troubles—in fact, in one 48-hour period we changed more than 40 engines to uncover a suspected defect.

B.E.A.'s experience of the Viscount [Mr. Masefield continued] is sufficient to lead us clearly to the policy view that we shall not buy any new major type of aeroplane with piston engines. We believe also that, throughout the foreseeable future, developed propeller-turbines will serve our particular needs better than would either any form of piston engine or turbojet. Our conclusion is based on some detailed analyses of projected aircraft designs which bracket sizes from 20 to 100 passenger seats and cruising speeds from 190 to 510 m.p.h.

[Before discussing, against the background of B.E.A.'s experience with the Viscount, their outlook towards future types and the progress expected from them, the lecturer surveyed the conception and development of the aircraft "to set both a pattern and a time scale for the future." The history of the Viscount was further dealt with in an extremely informative appendix to the lecture proper, and this we hope to publish in a subsequent issue of "Flight."]

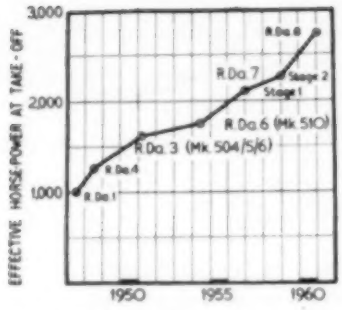


Fig. 4. Increase in power of the Rolls-Royce Dart turboprop.

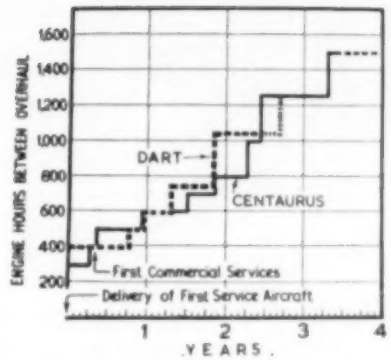


Fig. 5. Increases in engine overhaul life from beginning of airline service.

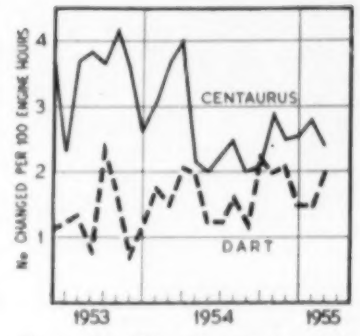


Fig. 6. Durability of power-unit components: number of defective items changed.

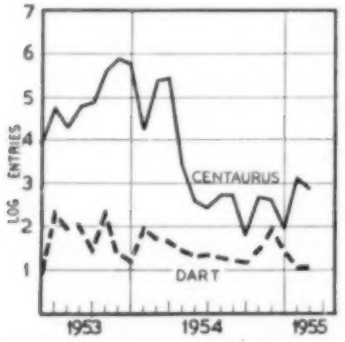


Fig. 7. Power-unit reliability in the air: number of defects reported in flight logs.

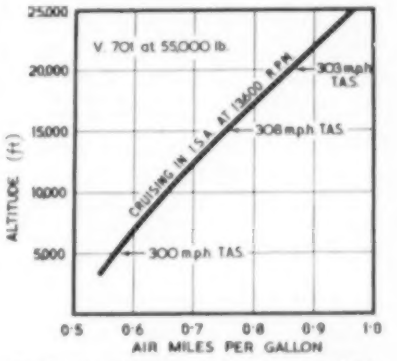


Fig. 8. Air miles per gallon achieved by B.E.A. Viscounts. Holding a.m.p.g. (140 kt) are similar.

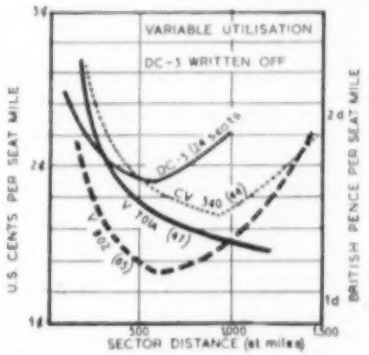


Fig. 9. Comparison of aircraft cost per seat-mile (U.S.A. cost structure) on short hauls.

During the first 200,000 engine hours of Dart flying in B.E.A.'s Viscount aircraft, between January 1953 and May 1955, occasions on which airscrews have been feathered on account of failures of components of the engine itself totalled one feathering, for all causes, in every 4,550 engine hours flown. This compares with one feathering for every 2,860 engine hours flown with the Centaurus piston-engine, which is comparable with the Dart as a new engine in civil airline and B.E.A. service.

Details of causes of Dart featherings during the first 200,000 turboprop engine hours of B.E.A. flying were then set out by the lecturer in the following form:—

Cause of Feathering	Number of occasions	Percentage of total featherings	Engine Hours per feathering
(1) Instruments and electrics	54	49	3,705
(2) Reduction gear (torquemeter) (engine)	17	15	11,760
(3) Fuel system	13	12	15,390
(4) Miscellaneous mechanical defects (engine)	11	10	18,200
(5) Turbine blades and bearings (engine)	7	6	28,600
(6) Accessories—Fuel pump etc. (engine)	5	4	40,000
(7) Combustion system (engine)	4	4	50,000
Total featherings in 200,000 engine hours.	111	100	1,800

Out of 111 featherings [continued the lecturer] only 44, or 40 per cent, were caused by failure of the engine itself—averaging one feathering in every 4,550 engine hours.

Dart featherings in the air which necessitated a subsequent engine removal have amounted to 31 altogether in 200,000 engine hours—an average of one for each 6,500 hours since the start of operations. This compares with one for each 11,000 hours for the Centaurus—which is a very good figure indeed.

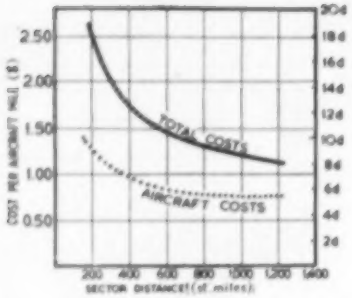
In all, 137 time-expired Dart engines have been removed at a mean time of 618 hours between overhaul while lives have been built up. In addition there have been 142 premature removals for various causes; such removals are now becoming progressively less. Incidentally, Dart engine changes can be performed comfortably in two hours.

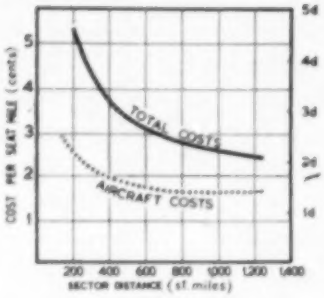
B.E.A.'s Darts are now running at 1,050 hours between overhaul, with flame-tube changes at 750 hours. This latter figure is on the point of being increased to 1,050 hours. Achieved hours since the start are, naturally, somewhat less than this but, there is plenty of evidence to lead us to believe that the achieved hours between overhaul will increase substantially during the next years. We are setting as our immediate target at least 1,250 hours between overhaul for the complete engine including the flame-tubes. This is part of the longer-term target of at least 2,000 hours for the cold part of the engine.

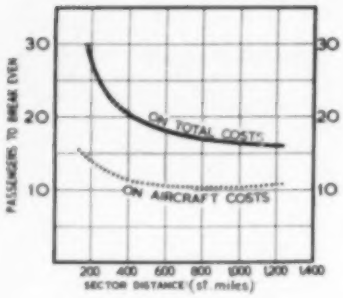
Flying Experience. Looked at now from the pilot's point of

TABLE IV: ROLLS-ROYCE DART TURBOPROP ENGINES

	Engine designation		Reduction gear ratio	Take-off performance I.S.A.C.			Max. cruising performance 20,000ft, 250 knots I.S.A.C.				Date	Aircraft in which installed
	M.o.S. designation (power rating)	Mark No.		Power		r.p.m.	Power		r.p.m.	Specific fuel con. lb/hr/b.h.p.		
				e.h.p., thrust	e.h.p.		e.h.p., thrust	e.h.p.				
1	R.Da.1	—	0.091	1,000 + 325 lb	1,125	14,300	530 + 55 lb	642	12,900	0.8	Oct. 1947 to end 1948	Flown in Lancaster nose. Installation trials in Wellington
2	R.Da.2	—	0.091	600 +			400 +					Not flown
3	R.Da.3	(a) 504	0.091	1,400 + 365 lb	1,547	14,500					Pre-production	Dart-Dakota
		(b) 505	0.106	1,400 + 365 lb	1,547	14,500	858 + 70 lb	912	13,800	0.722	Production, 1952	Viscount V.700 series
		(c) 506	0.106	1,400 + 365 lb	1,547	14,500	948 + 70 lb	1,002	13,800	0.67	Production, 1955	Viscount V.700 series
4	R.Da.4	502	0.106	1,250 + 340 lb	1,380	14,500	750 + 65 lb	800	14,000	0.76	1950	Viscount V.630 prototype
5	R.Da.5	—	0.106	1,640 + 365 lb	1,780	14,500	990 + 70 lb	1,044	13,800	0.658	Projected, July 1953	Projected for V.801
6	R.Da.6	510	0.093	1,600 + 370 lb	1,780	14,500	967 + 70 lb	1,021	13,800	0.662	Production, June 1955	Viscount Major V.802
7	R.Da.6	511	0.086	1,600 + 370 lb	1,780	14,500	967 + 70 lb	1,021	13,800	0.662	June 1955	Fokker Friendship
8	R.Da.7 Stage 1	—		1,950 + 430 lb	2,115	15,000	1,160 + 78 lb	1,220	14,000	0.583	Dec. 1956	V.800 development
9	R.Da.7 Stage 2	—		2,100 + 435 lb	2,268	15,000			14,000			







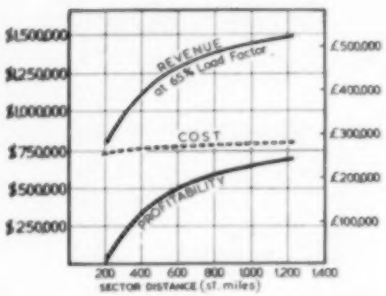


Fig. 10. B.E.A. Viscount operating economics under European conditions. Variation with sector distance of costs per aircraft - mile and per seat - mile, number of passengers to break even, total annual cost, revenue and profitability are shown.

THE TURBOPROP IN PRACTICE . . .

view [said Mr. Masefield] the most striking thing about the first generation of turboprop aircraft is that their hourly fuel consumption is about double that of equivalent piston-engined aircraft. With the Viscount, it has worked out in practice over all operations to a mean consumption of some 355 U.S. gallons an hour of kerosine fuel, and only approximately one-third of a U.S. pint an hour of lubricating oil, for all four engines. The Viscount's cruising hourly fuel consumption at 5,000ft is 45 per cent greater —at 532 U.S. gallons an hour—than is the consumption under equivalent engine conditions at 20,000ft; but this difference can, however, be greatly improved during holding by specific techniques.

On occasions in which air traffic control restrictions on climb are imposed during outward clearances from congested control areas, B.E.A. normally add "low-level fuel" to the total uplift at the rate of six gallons for each ten nautical miles of expected low-level cruising. Most flights out of London Airport carry between 30 and 36 U.S. gallons of additional low-level fuel.

Obviously, entry into congested control areas has also presented certain special problems; the procedure in the London area—which combines poor weather with the highest congestion experienced in Europe—is normally to hold Viscounts in the stack at 20,000ft or more over the main beacon at Epsom, in Surrey. The Epsom Stack normally accommodates piston-engined aircraft at between 9,000 and 4,000ft, and is fed with such aircraft from other stacks 20 or 30 miles away. Viscounts are integrated with the piston-engine aircraft in the normal sequence, but are fed straight down to the main stack from the higher holding level.

At 20,000ft, and at a holding speed of 140 kt I.A.S. (192 kt T.A.S.) the Viscount consumes about 265 U.S. gallons an hour compared with 373 U.S. gallons at the same height cruising at 278 kt T.A.S. The rate of consumption increases at lower levels, but not to the extent that has sometimes been suggested. This is chiefly because the minimum comfortable true airspeed can be reduced at lower levels, so reducing the power and fuel required. Fuel consumption while holding at 5,000ft and at 140 kt I.A.S. (150 kt T.A.S.) is only seven per cent more than that experienced under the same holding conditions at 20,000ft. (140 kt I.A.S. but 192 kt T.A.S.).

In general, although the turboprop does not demand the same quick reactions in the cockpit as Comet experience indicated is necessary with the pure turbojet, it does require somewhat faster thinking than is necessary in normal piston-engine flying. In B.E.A., ground training for this condition has been greatly helped by timing navigational exercises with a special clock which shows an hour of "apparent time" during 40 minutes of "real time"—thereby keeping everyone "on the hop." In contrast, a 60-minute hour in the air seems quite leisurely.

Until 1950 B.E.A., like all other short-haul operators, employed a "fixed sector fuel" system on all schedules. At that time [continued Mr. Masefield], looking towards the requirements of the Viscount, we introduced to our piston-engine operations the "variable fuel" method, which avoids an important part of the serious loss in payload that is otherwise inevitable on short hauls and also ensures that crews maintain a much closer control of their fuel state than was previously the case. Pioneered and proved on the piston-engined Viking, B.E.A.'s variable fuel method now greatly benefits not only all Viscount operations but also those of the piston-engined Elizabethan and DC-3 as well.

Another practice adopted by B.E.A. is the precise and systematic measurement of the performance of each aircraft at regular intervals after completion of major overhauls. In this way there has been obtained—and continuously maintained—an accurate picture of how each aircraft is matching up against its Flight Manual performance. The Viscount's fleet performance is illustrated by Fig. 11, showing that the average speed achieved by V.701s powered with the Dart 505 engines is 308 m.p.h. Speeds are now being increased by some 20 m.p.h. by substitution of Dart 506 engines for the 505s.

The fact that the idling consumption of four Darts runs at the rate of 130 U.S. gallons an hour led B.E.A. to adopt, from the start, the practice of normally obtaining outward clearances for the Viscount at the apron ramp before starting the engines.

B.E.A.'s flying staff's reactions to the Viscount has been enthusiastic. Not only do they like its handling characteristics but they now enjoy visiting the passenger cabin where they now get compliments on their aeroplane showered upon them—particularly by the American passengers.

Viscount Economics. We in B.E.A. [said Mr. Masefield] have, for our own commercial requirements, made a detailed analysis of Viscount economics under all operating conditions and for a series of sector distances, with full allowances and reserves, ranging from 50 miles on our domestic routes inside the United Kingdom, up to 1,230 miles on our international network in Europe and Africa.

In this analysis, for practical purposes, we have fed into the calculations the following variables, which have been cross-checked against achieved results:—

(1) *Payload:* which, for the V.701A (with B.E.A. fuel reserves and a maximum take-off weight of 60,000 lb) is constant at 11,808 lb up to a sector distance of 950 sector statute miles and then falls to 9,858 lb at the maximum sector distance of 1,230 miles.

(2) *Block speed* (cruising at 320 m.p.h. T.A.S. at 20,000ft at maximum weight): which, with B.E.A. time allowances, varies for the V.701A from 139 m.p.h. at 100 miles' sector distance to 281 m.p.h. at the maximum sector distance of 1,230 miles.

(3) *Utilization:* which (for a transit time of one hour and a 14-hour working day—representative of European conditions) varies for the V.701A from 1,250 hours per annum (four hours a day) at 100 miles' sector distance, to 2,400 hours per annum (7.8 hours a day) at the maximum sector distance of 1,230 miles.

(4) *Revenue rate:* which, on B.E.A. international routes, varies from 87.0 cents per load ton-mile at 100 miles to 66.1 cents per ton-mile at 1,086 miles.

(5) *Total cost ratio:* the ratio of total costs to aircraft costs (direct operating costs) which, on B.E.A.'s structure, varies from 2.2 to 1 at 100 miles to 1.4 to 1 at 1,230 miles.

B.E.A.'s studies show that the most economic sector for the V.701A (Dart 506) on a seat-mile basis is 1,230 statute miles and that—in European conditions—over this distance each V.701A can earn a profit of some $700,000 per annum on B.E.A.'s international services at a 65 per cent passenger load-factor. These figures do, we believe, compare favourably with any other equivalent transport aeroplane. Total cost of operating a Viscount—including all overheads and interest on capital—is almost constant at $775,000 per annum in B.E.A. service, irrespective of sector distance.

As a 47-passenger aeroplane, the V.701A is thus a thoroughly economic vehicle which is still improving. But the Viscount Major V.802 will improve the position still further when it comes into B.E.A. service late in 1956. The V.802 has two basic, but quickly interchangeable forms—first a 53-passenger aeroplane with full catering; and secondly a 65-passenger short-haul type with reduced catering. The maximum sector distance of the Viscount Major with full payload of 12,826 lb is 540 statute miles—and, with a reduced payload of 6,300 lb it is 1,430 miles. We are of the opinion that, when the Viscount Major comes into B.E.A. service in 1956, it will be ahead of any contemporary aeroplane in passenger and airline appeal for the range of sector distances over which it will be operated—from 95 up to 1,086 statute miles.

Future prospects.—Looking ahead [said the lecturer] we in B.E.A. believe that the propeller-turbine engine will prove to be a major factor in the safe, economic and expansive development of air transport in the next 15 years.

Although the theoretically achieved economics of the turbojet are closely similar to those of the turboprop, operational problems will tend to increase the achieved costs of operation quite substantially, giving the turboprop, in practice, a clear economic edge over the turbojet.

This is not to imply that the turboprop will, in all instances,

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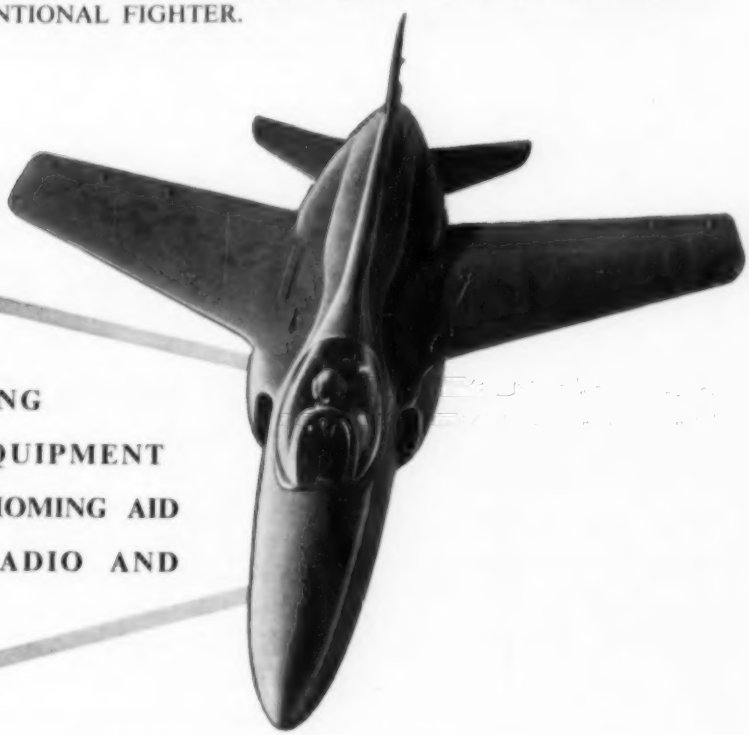
In speed, radius of action, climb, service ceiling — in all important features of flying and operational performance — the Gnat light fighter more than matches the conventional fighter. It can carry all the electronic equipment specified for the normal intercepter fighter.★ As a tactical fighter it lifts a full and effective load of bombs, rockets, or other missiles. It has two hard-hitting 30 mm. cannon, a form of armament which is finding increasing favour among air forces. Its excellent stability makes it a steady firing platform for cannon and rockets at all heights and speeds.

AS A COMBAT AIRCRAFT THE GNAT THEREFORE HAS A STRIKING POWER AT LEAST EQUAL TO THAT OF THE CONVENTIONAL FIGHTER.



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(4) is easier to produce.

(5) costs far less to buy and operate.

Both the Gnat and its low-power prototype, the Midge (pictured above), are private ventures by :

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THE TURBOPROP IN PRACTICE . . .

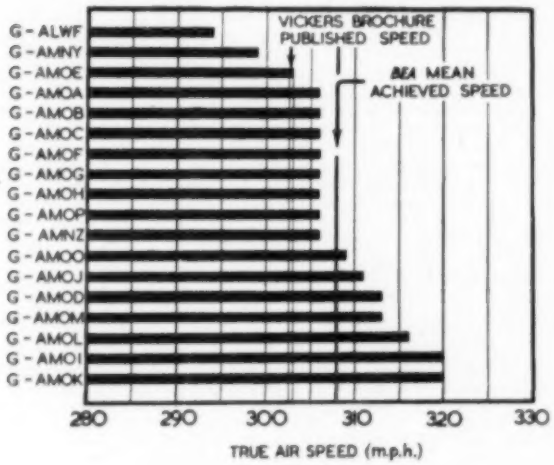
prove superior to the jet in airline service. There are routes over which the higher speed of the jet will justify, economically, its higher achieved operating costs and its lack of operational and economic flexibility. High load-factors may be achieved at higher fares where the speed gains are especially attractive. I am sure, that, during the next decade, we shall see both the turboprop and the turbojet flying side by side on different types of airline service. There will always be a place for the fastest possible "blue-riband service" so long as it can be provided at costs which are within a reasonable percentage of the normal. But I believe, also, that there will be larger numbers of turboprop aircraft—and that they will be able to be operated at cruising speeds up to at least 460 miles an hour. Certainly, over short and medium-haul routes, the type of 75-passenger, 410 m.p.h., 90,000 lb, 1,200-mile turboprop aeroplane investigated would be a most formidable proposition throughout the nineteen-sixties.

And in all this the characteristic of the turboprop which stands out is its operational flexibility—combining a comparatively high speed with low costs and engineering simplicity. Add to that great passenger attraction, and you have an exceedingly competitive vehicle.

The Britannia is due to come into service with B.O.A.C. during 1956 and is likely to demonstrate the advantages of the turboprop over long ranges as convincingly as the Viscount has done over short. Currently B.O.A.C. has 33 Britannias on order, 15 with four 3,780 e.h.p. Bristol Proteus 705 and 18 with four 4,150 e.h.p. Bristol Proteus 755 free-turbine axial-flow turboprop engines. They include: 15 Britannia 100s (84 tourist passengers), eight Britannia 300s (96 tourist passengers) and ten Britannia 300 LR (96 tourist passengers). In addition B.O.A.C. has ordered 60 of the new 5,050 e.h.p. Bristol BE.25 engines for future installation in these aircraft.

The Britannia has already demonstrated the sort of performance

Fig. 11. Variation in cruising performance between individual aircraft (at 55,000 lb a.u.w., 22,500ft altitude, and I.S.A. conditions).



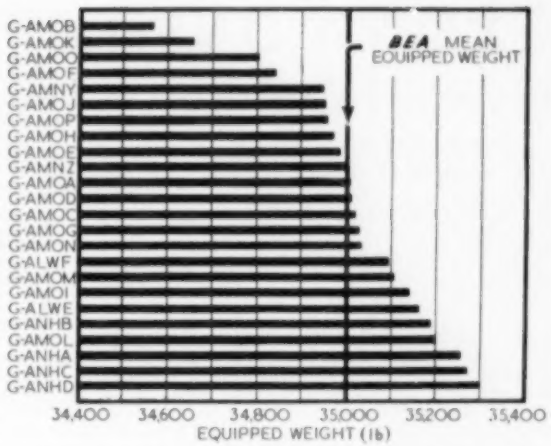


Fig. 12. Variation in equipped weight of individual aircraft in B.E.A. Viscount fleet.

of which it is capable by flying the 3,150 statute miles non-stop from Bristol to Khartoum in 10 hours 55 minutes against strong headwinds. There can be no doubt that this new long-range turboprop aeroplane will have a most important impact on commercial air transport throughout the world during the next few years.

Conclusion.—Summing up [concluded Mr. Masefield] we in B.E.A. believe that the civil transport aeroplane powered with turboprop engines has important advantages over both piston-engine and the turbojet aeroplanes, over all ranges, on the following points.

The turboprop has proved itself to be in service substantially the quietest type of powerplant available.

The turboprop and the turbojet are both substantially quieter than piston-engined aircraft. The turboprop is least quiet in the plane of the propellers, the turbojet at the after-end of the cabin behind the jet-pipes.

The turboprop has substantially less vibration than piston engines and is insignificantly inferior to the turbojet.

The turboprop has no plugs, no magnetos, no carburettors, no valves, no reciprocating parts. Its maintenance in service has been proved to require substantially less man-hours than does the piston engine.

The turboprop is less rigid in its operational demands than is the turbojet. In B.E.A. we have proved to our satisfaction that it can be operated in a perfectly normal manner into congested air traffic control patterns.

We are certain that turboprop reliability will eventually outstrip any piston engine.

The success of the Viscount is inseparably bound up with the success of the Dart. We have now had sufficient experience of this engine to feel satisfied that its characteristics are quite straightforward and that there are no hidden snags in its operation.

We believe, in fact, that in air transport the second half of the decade of the "flying fifties" may well prove to be the era of the turboprop.

UNIFIED-THREAD PROGRESS

"UNIFIED" *versus* "Whitworth" was the issue under discussion at a special conference called recently by the British Standards Institution. It was ultimately decided, by representatives of many branches of the engineering industries and Service departments, that the Unified screw thread would eventually supersede the Whitworth thread.

The opening discussion recalled how, seven years ago, America, Britain and Canada agreed to accept the Unified thread. In the years immediately following the signing of the agreement several British standards were evolved for Unified bolts and nuts, screwing tackle and other details necessary for its implementation. Since then, the manufacturers of bolts and nuts had said that they had been unable to meet all the immediate demands for Unified products; lately, however, the position had improved, and no serious difficulty was foreseen in meeting any future demands.

Representatives from the aircraft, motor, oil and chemical industries, and from the Atomic Energy Authority, all confirmed that they had adopted the Unified thread and that its availability now presented no problems.

The conference decided that the three key factors in the further progress of the change-over were:—

(a) *Large organizations such as the nationalized industries* which placed many large orders for equipment, and which, by specifying Unified threads, could help to influence and speed the change-over;

(b) *The stockist*, who was responsible for supplying small orders to a great number of small firms; and

(c) *The many small manufacturers*, who produced miscellaneous industrial equipment with tapped holes.

The indications all showed that the rate of change-over had been considerably faster than had been expected; but, considering the advantages of working to a single screw-thread system—particularly one likely to receive increasing support in Commonwealth and overseas markets—it was generally agreed that the change-over should be hastened.

The British Standards Institution was asked to take the appropriate steps to secure wider publicity for this objective. The conference is to meet again in six months to review progress.

LOW-CONSUMPTION TURBINES

Some Rolls-Royce Achievements: Mr. Lombard's Lecture at the Anglo-American Conference

ALTHOUGH "there is no aspect of turbine engines more restricted by security than that of fuel consumption," Mr. A. A. Lombard, F.R.Ae.S., chief engineer of the Rolls-Royce aero-engine division, has prepared a paper on this subject, and it was read before the Anglo-American (R.Ae.S.-I.A.S.) conference in Los Angeles this week. The opening words above, incidentally, are a quotation from Mr. Lombard's introduction.

It was, said Mr. Lombard, not possible to avoid introducing aircraft performance considerations when attempting to define the optimum engine for a given application. For example, the effect on payload or range of having a heavy or inefficient engine was not great in short-range aircraft, but at higher ranges the effect became catastrophic. One of the objects of the paper would be to stress the importance of light weight, as well as low s.f.c. (specific fuel consumption), in engines for long-range aircraft.

Study of curves of s.f.c. and specific weight for various Rolls-Royce gas turbines (plotted against an historical time-base) suggested that further improvements would be small. It was highly likely that every general type of gas-turbine configuration had already been considered, and that—unless something basic had been overlooked—further progress would depend largely on detail refinement.

The lecturer went on to assess the relative importance of specific weight and consumption. At a fixed altitude and speed, it was quite simple to express range as proportional to a formula involving both parameters. Another important relationship was that existing between the two parameters; if, for example, a one-per-cent change in specific weight brought k per cent improvement in s.f.c. then the result of: (per-cent decrease in s.f.c.) minus (k times per-cent increase in powerplant weight) had to be positive, if the modification was to be worth while. It was found that the primary variables affecting k were time and altitude, a reduction in the former and an increase in the latter having the effect of reducing the fuel required, and hence making engine weight of greater relative importance. Two of Mr. Lombard's illustrations were plots of k against stage-time for selected cruising altitudes assuming a cruising speed of, in the first case, 550 m.p.h., and in the second, over Mach 2. It could be deduced that, for similar stage-lengths, the relative importance of specific engine weight and fuel consumption would not differ greatly between the two types of aircraft.

Two other methods of assessing k were also described by the lecturer: the selection of aircraft cruising speed and altitude to suit the particular engine and the choice of total engine/fuel loads to suit the particular engine. In the latter case, the lightest engines were used to increase wing loading and hence cruising speed (up to any limit set by Mach number). Briefly, if engine and airframe were truly optimized, then a percentage change in weight was worth approximately half the amount in percentage consumption.

Turning to the assessment of the effect of design variables, it was assumed that a basic design was available which was as good as current knowledge could make it. The established methods of increasing engine performance (the effect of which on cycle performance was generally familiar) were then examined from the point of view of weight, and hence range.

Increasing the compressor pressure-ratio meant increasing the number of stages and probably, in the limit, adding a turbine stage also. Owing to the temperature rise it was necessary to make the extra stages of steel; furthermore, the flame tubes would run hotter (for the same design standard of cooling) involving increased weight, and, where bleed air was used for sealing or cooling, the reduced cooling effectiveness would again require weight increases, and the greater cooling flow needed would detract from performance. The weight increases were of less importance in turboprops, where the weight of the main compressor/turbine assembly was a low proportion of the total engine weight.

A plot of specific weight and consumption against pressure-ratio for two combustion temperatures and two flight durations showed flat optima. It could be concluded that in going above pressure ratios of the order of 8:1 an increase in range of only 3 to 5 per cent was possible; and, for the best conditions, 12:1 seemed to be the practicable limit. A similar picture could be drawn for the turboprop (Fig. 1). It could be seen that, in this case, worthwhile gains were possible, and that a figure of 350 deg C temperature rise (much in advance of existing designs) appeared a suitable optimum.

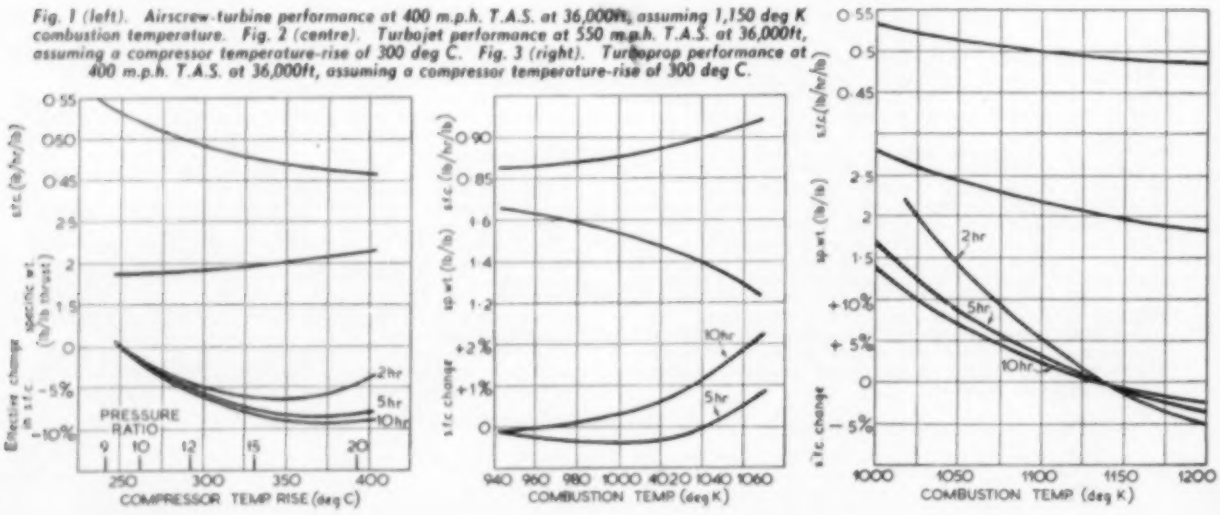
For a pure jet engine, increasing combustion temperature increased the jet velocity and thus reduced propulsive efficiency, so offsetting the gain in basic cycle efficiency. On the other hand, in a turboprop there was every advantage in increasing combustion temperature. Unfortunately, there was a debit side in engine weight, owing to the arduous combustion-chamber conditions; further, there might be a performance loss as a result of increased cooling airflow. A plot for a turbojet (Fig. 2, below) showed a flat curve for a 5 hr flight, but a debit was incurred at 10 hr. It seemed from these curves that little would be gained by increasing combustion temperature above about 1,050 deg K.

For the turboprop (Fig. 3) range continued to increase with flame temperature, particularly at short ranges where engine weight was more important. Although the percentage increase in range fell off at high ranges, for a constant range the results implied an almost constant addition in payload. Thus, at long range the percentage increase in payload was much greater.

For the turboprop, therefore, one could see high pressure ratios and high temperatures ahead. Cooled turbines would be essential, and much progress had been made in their development. The problem was to engineer an air-cooled blade with adequate mechanical strength; also, the cooling had to be accomplished with the minimum amount of air, in order to avoid exorbitant penalty in performance. There was a fine balance in selecting the right flow of air that could be used for cooling with high flame temperatures if inefficient expansion of this air was not to introduce a performance penalty. This might involve a multi-pass system, in which the cooling air flowed over the maximum surface area at as high a velocity as was possible with the available pressure drop. A prerequisite was very efficient aerodynamic design of cooling-air passages.

Considerable work was being done in attempting to increase component efficiency. Some increase in compressor efficiency might result from reduction in stage loading and speed, but would imply weight increases. Some weight reduction might result from the use of transonic stages without too much loss in efficiency; but the greatest gain would probably result from the introduction of new materials, such as titanium alloys. Many were of the opinion that, were combustion chambers treated as scientifically as the compressor and turbine, large reductions in

Fig. 1 (left). Airscrew-turbine performance at 400 m.p.h. T.A.S. at 36,000ft, assuming 1,150 deg K combustion temperature. Fig. 2 (centre). Turbojet performance at 550 m.p.h. T.A.S. at 36,000ft, assuming a compressor temperature-rise of 300 deg C. Fig. 3 (right). Turboprop performance at 400 m.p.h. T.A.S. at 36,000ft, assuming a compressor temperature-rise of 300 deg C.



size—and therefore in engine casing and shafting weight—should be possible. It seemed unlikely that large gains in overall turbine efficiency would be possible.

The most fruitful source of efficiency gains lay in the numerous detail parasitic losses. Leakage, particularly in a small engine where the ratio of tip-clearance:blade-height was large, depended upon good bearing location, rigid shafts, concentric and distortion-free casings, and with strains and expansions well matched under all conditions. The author illustrated a typical Rolls-Royce turbine, with one H.P. and three L.P. stages, supported by a roller bearing at both front and rear and with a labyrinth tip seal around the shrouded rotor blades.

The paper went on to stress the supreme importance of controlling the weight of rotor blades. For adding a known weight to the *tip* of a blade a growth factor could be applied; in a typical turbojet, 1 lb more on the tip of the compressor rotor involved a total engine-weight penalty of 12 lb, which would then have to be multiplied by the aircraft growth factor.

To obtain an idea of the efficiency of converting fuel energy into work, a forward-speed term had to be introduced. In Fig. 4 a high-efficiency turbojet and turboprop were compared over a range of Mach numbers. The turbojet operated at maximum thermal efficiency at around M = 2.5, the exact value varying with intake efficiency. The high-pressure turboprop found its maximum efficiency at about M = 0.6, this value largely depending upon the airscrew efficiency. Between these two extremes were the simple turbojets, of increasing pressure ratio as flight Mach number was reduced. For comparison, a high-pressure-ratio by-pass engine was also included. These efficiency curves had to be weighted to allow for the differing powerplant weights; such a weighted curve was shown for a turboprop. It was this weighted curve which, added to the thermal efficiency curve, indicated the optimum form of propulsion for a given flight-speed.

A great deal of investigation into the by-pass engine had been made. Such engines had over-size early compressor stages, the excess air being by-passed to rejoin the main stream directly behind the turbines. At the order of speeds considered, the result was a propulsive efficiency better than that for the turbojet, and this factor, in turn, permitted the use of higher cycle temperatures. On the other hand, for a given thrust, the mass flow and engine weight would be higher.

A precise comparison could be made between the turbojet and the by-pass engine, in which the high-pressure sections of the two engines were actually scales of each other. The turbojet combustion temperature could be reduced until its s.f.c. equalled that of the by-pass engine. To achieve this, it was necessary to depress the temperature to some 120 deg C below that of the by-pass unit, and it was found that the engine weight was then some 16 per cent greater and the installed weight some 20 per cent greater. For high-altitude long-range operation, this would lead to a five per cent gain in range.

One could design the turbojet and the by-pass to the same take-off thrust at the same combustion temperature. Then, the altitude performance could be compared as shown in Table I.

TABLE I: BY-PASS:TURBOJET PERFORMANCE RATIOS

550 m.p.h., 40,000ft	Same Combustion Temp.	Same Thrust	Same s.f.c.
Thrust	0.925	1.0	1.33
S.f.c.	0.93	0.955	1.0
Combustion temp. (deg K)	1,040	995	885

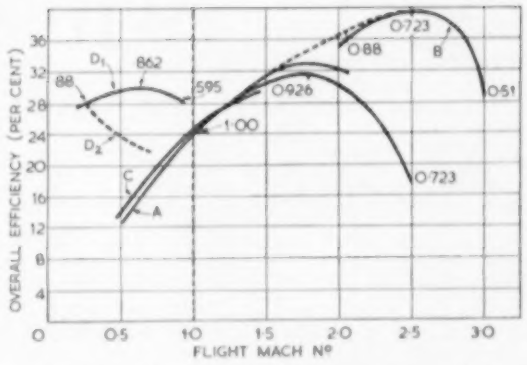


Fig. 4. The overall efficiency of various types of powerplant. Curves are: A, high-pressure-ratio turbojet; B, low-pressure-ratio turbojet; C, high-pressure-ratio by-pass; D_1, turboprop; D_2, "weighted" turboprop curve. The random numbers are propulsive efficiencies.

It could be seen that the by-pass was roughly five per cent better all-round. A further very useful characteristic of the by-pass engine was its low noise level. Other gains in ease of installation were possible, as a result of the reduced surface temperature. In a conventional buried turbojet installation, fire-proof bulkheads weighed 80 lb (three per cent of engine weight), and cooling air flow amounted to 3.5 per cent of the total mass flow, representing a drag equivalent to two per cent of engine thrust at representative flight conditions. Another 50 lb penalty was required by the fire extinguishing system. The by-pass engine normally had a surface temperature of some 100 deg C (150 deg C maximum after take-off in tropical conditions). This did not eliminate the need for fire protection or ventilation, but showed that the problem was greatly eased in comparison with a turbojet.

Generalizing, it was the author's opinion that about 425 m.p.h. represented a fair upper limit for the turboprop, and it was stressed that at such speeds *absolute* dependence had to be placed on airscrew safety devices. Should the airscrew tend, inadvertently, to "fine off" in flight, enormous drag and overspeeding would result. Overall, however, the future of the turboprop seemed very rosy. The first commercial turboprop machine had proved itself capable of earning a profit, although its engines were some of the earliest turboprops ever designed (in which the component efficiency and design standard achieved in turbojets had not yet been incorporated).

For the distant future, however, the turbojet seemed to be an ideal power unit for quite high supersonic speeds. In spite of the low cruising lift/drag ratios, it was clear that aircraft operating at Mach numbers as high as 2.5 could compete with "high-subsonic" types, and could give really worthwhile reductions in long-range block times. For example, two return Atlantic crossings could be made in one day.

BOULTON PAUL INITIATIVE

IN his statement issued in advance of the annual general meeting of Boulton Paul Aircraft, Ltd., on June 16th, the chairman, Mr. J. D. North, spoke of the company's particular ability to make specialized contributions, assessed in advance, to changing trends in aircraft development. Such a policy, he said, necessitated investment—not least in intangible assets—much of which was of a long-term character. Conditions of official secrecy made it difficult to be more specific, but it could be said that already a large majority of the heavy bombers for the R.A.F. were using Boulton Paul powered control systems; he thought the work the company had done, and was doing, in this direction was likely to assure a continuance of its lead.

The balance sheet presented at the meeting showed a net profit, for the year ended July 31st, 1954, of £270,085 before taxation (previous year, £226,483). A final dividend of 15 per cent, less tax, was recommended.

MR. ARTHUR AINSWORTH

WE record with regret the death of Mr. Arthur Ainsworth, M.B.E., on June 5th, following a short illness. He was a well-known member of the A. V. Roe organization.

Mr. Ainsworth joined Avros in 1915, working in the erecting shop, and later travelled abroad for the company as service engineer. In the inter-war years, as manager of the Woodford Aerodrome, he was responsible for preparing several aircraft which later completed outstanding flights. Among these were Bert Hinkler's Avian, which in 1928 flew to Australia in 15½ days, and Kingsford-Smith's Avro X, which made a similar journey four years later in 12½ days.

Perhaps Mr. Ainsworth's best-remembered achievement was the organization of some 2,300 workers, during the peak wartime production period, to build 40 Lancasters per week. In recognition of this work he was appointed M.B.E. in 1945. After semi-retirement in 1949, he supervised maintenance matters at Woodford Aerodrome. Mr. Ainsworth leaves a widow and a son.

NEW BRITISH STANDARDS

RECENTLY issued British Standards for aircraft components include the following (obtainable at the prices quoted from the sales branch of the British Standards Institution at 2 Park Street, London, W.1): 2 SP 105—*Swaged cable-end assemblies (Unified threads) for preformed steel wire rope (W.9)* (price 4s); 2 SP 106—ditto, for *preformed non-corrodible steel wire rope (W.11)* (4s); 2 G.111—*Rate-of-climb indicators* (2s. 6d); SP. 61 to 64—*Wood-screws* (4s); G.150—*Tachometer indicators, synchronous type* (2s 6d); SP 59 and SP 60—*Spring catches* (2s 6d); SP 114—*Eye-bolts (Unified threads)* (2s 6d); E.22—*Dummy sparking-plugs* (2s).

CIVIL AVIATION

NEWS OF THE VISCOUNTS — 24 MORE ORDERED

DETAILS of five new contracts for Viscount turboprop airliners were published last week by Vickers-Armstrongs, Ltd. Perhaps the most significant of the contracts was that signed by K.L.M. Royal Dutch Airlines for nine extended-fuselage Viscount 803s of the basic type developed for shorter-haul, high-density work at the initiative of B.E.A. To be delivered in mid-1957, the aircraft will cost K.L.M. some £3,500,000, plus £500,000 for "substantial spares." They will be used on both European and Near Eastern routes.

This is the first time in 35 years' operations that K.L.M. have placed a sizeable order with the British aircraft industry. The airline's decision to adopt the turboprop (first signified by the recent order for two Dart-powered Fokker Friendships) may well influence other European operators—including, possibly, Sabena and Swissair, with whom K.L.M. have long been associated in the pooling of Convair spares and equipment.

Powered by four Dart 510s and having a gross weight of 62,000 lb, the Viscount 803 will carry a 12,000 lb payload plus full K.L.M. reserves over a 600-mile stage. Cabin accommodation will be for 37 tourist and 16 first-class passengers in separate compartments, or for 70 passengers in the all-tourist version. Externally, the Viscount 803 and 802 (B.E.A. version) will be identified by a 3ft 10in fuselage stretch; a rearward movement of the after pressure bulkhead increases the effective cabin length by a further 5ft 5in.

Also announced—on Friday last—was B.O.A.C.'s order for 12 Viscount 700Ds, for delivery in mid-1957. Sir Miles Thomas recalled that the Corporation had already ordered four Viscounts (on behalf of British West Indian Airways) for operation in "the Caribbean area and the Florida dollar shop window." He added that "some of these additional Viscounts will be used in order to consolidate the position of British propeller-turbine airliners in the Middle East area." The announcement follows closely the recent decision to set up a British aircraft supply, servicing and training organization, to be known as M.A.S.C.O., in the Middle East. This company will be based in Beirut, and its main co-sponsors are B.O.A.C. and Hunting-Clan Air Transport. It has already been announced that three Hunting-Clan Viscounts will be made available for Middle East operations through M.A.S.C.O., and B.O.A.C.'s object in ordering the extra Viscounts is presumably to increase the pool of aircraft available for lease or time-charter to Middle East regional airlines who need new equipment but are not yet in a position to purchase and operate their own turboprop fleets.

The Howard Hughes Tool Co. of Delaware and the Standard Oil Co. of California have each ordered one Viscount, and Vickers have also confirmed the recently reported U.S. Steel Corporation order for three executive Viscounts. The significance of the Howard Hughes order lies in the association between the Hughes Tool Co. and Trans World Airlines. The aircraft, a Viscount 700D powered by Dart 510s, will be of similar layout to those ordered by Capital Airlines, and will be used for "study and analysis" of the operation of turboprop aircraft.

The Viscounts ordered by U.S. Steel and Standard Oil of California will be used as executive transports. Vickers attach particular importance to these contracts, for they represent the company's first foothold in an extremely large market: over 1,000 twin-engined aircraft are used as executive transports in America and several hundreds of these are regarded as being "potentially replaceable" by Viscounts. The U.S. Steel machines will be specially equipped to cover very long ranges; each will be fitted with two 145-gallon slipper tanks and a 450-gallon belly tank, giving a total fuel capacity of 2,640 gallons and a still-air range —with ten passengers aboard—of nearly 2,900 miles. In effect these aircraft will be airborne conference rooms capable of spanning the United States in a single flight.

The fifth announcement of the week, bringing the Viscount sales score to 227, concerned the ordering of a third Viscount by the Norwegian independent airline Fred Olsen Airtransport, Ltd. This is the seventh repeat order for Viscounts. It is now likely that Fred Olsen will take delivery of all three Viscounts in 1957, since the two aircraft originally ordered by this company (in January 1954) are to be operated by B.E.A. on a two-year lease.

Mr. G. R. McGregor, president of T.C.A., who have ordered a total of 25 Viscounts, said last week that his company might find it necessary to buy yet more. Since the introduction of T.C.A.'s Viscounts on April 1st the only difficulty encountered had been lack of sufficient seats to meet the demand: 84 per cent of the 200 seats operated in each direction daily between Toronto and New York were filled and regularity was the best in the history of the service. Mr. McGregor prefaced his remarks with this resounding tribute to the aircraft: "In my opinion, the Vickers Viscount is by a very wide margin the best commercial aircraft of its class that has ever been built."

S.A.S. have lately renewed their long-standing interest in the Viscount. A spokesman of the airline said in Stockholm last week that the S.A.S. board of directors were considering the purchase of the British turboprop airliners but that no immediate decision was expected.

Of the 227 Viscounts now sold, 58 have been delivered. The latest delivery was that of the first Capital Airlines Viscount, which left Wisley early on June 16th to arrive in New York that evening after refuelling *en route* at Prestwick, Keflavik, Bluie West One, Goose Bay and Montreal. Among those aboard were the president of Capital Airlines, Mr. J. H. Carmichael, his wife and daughter, and Mr. J. B. Franklin, vice-president. In command was Capt. Ralph Sewell, Capital's chief instructor, with Capt. Ed O'Donnell of Capital as co-pilot and Capt. R. Rymer as the accompanying Vickers pilot. From Washington, Capital's base, the aircraft is due to set off on a 12-day demonstration tour.

B.E.A. IDEAS AWARDS

FOR suggesting the application to B.E.A.'s operations of the variable fuel system mentioned in Mr. Peter Masefield's Anglo-American lecture (page 880), Mr. Kenneth G. Wilkinson has received a £500 reward—the largest ever made by the Corporation. Mr. Wilkinson is now B.E.A.'s schedules planning manager. For adapting and applying the basic idea to actual operations, Mr. J. Vivian, training and services manager in the flight operations department, receives a £250 award.

PANAIR ACCIDENT

CONSTELLATION PP-PDJ, operated by Panair do Brasil, crashed on June 16th during an approach to Asuncion, Paraguay. Of the 24 occupants, three crew and eight passengers survived, though most of the survivors sustained burns. The aircraft was making a scheduled flight from London to Buenos Aires.

MASEFIELD PRAISES BRITANNIA

IN the course of his paper on B.E.A.'s Viscount experience at Los Angeles on June 20th, Mr. Peter Masefield expressed the view that "the Britannia is likely to demonstrate the turboprop's advantages over long ranges as convincingly as the Viscount has done over short." To back up this view, he presented some impressive new figures (below) outlining the performances of the Britannia 300 L.R. (Proteus 755s each of 4,160 e.h.p.) and the "Britannia-Major" (B.E.25s of 5,060 h.p.). The B.E.25 is a "constant-power" turboprop, capable of giving its maximum output at heights of up to 20,000ft. B.O.A.C. have ordered 60 B.E.25s with a view to re-engining some of the 33 Britannias ordered for service on the Corporation's long-distance routes.

	Britannia 300 L.R.	"Britannia-Major"
Powerplant	Four Proteus 755	Four B.E.25
Take-off Power	4 x 4,160 e.h.p.	4 x 5,060 e.h.p.
Normal range of cruising powers at 97.5 per cent of max. r.p.m.	1,570 to 2,470 e.h.p.	2,100 to 2,900 e.h.p.
Mean cruising height	30,000ft	34,000ft
Mean cruising speed	356 m.p.h.	420 m.p.h.
Maximum gross weight	170,000 lb	170,000 lb
Normal passenger accommodation	96	96
Maximum Payload	28,000 lb*	28,000 lb*
Sector distance with 25,000 lb of payload	4,300 s.m.	5,500 s.m.
Corresponding still-air range	5,270 s.m.	6,665 s.m.
Maximum sector distance with full tanks at maximum take-off weight	5,100 s.m.	6,100 s.m.
Corresponding still-air range	6,160 s.m.	7,410 s.m.
Payload with full tanks	17,500 lb	20,000 lb

*For structural reasons the maximum payload is limited to 25,000 lb at gross weights in excess of 165,000 lb.

ELIZABETHANS WITH TURBOPROPS

NEWS of two experimental turboprop conversions of the Elizabethan is given in the current issue of the *B.E.A. Magazine*. The first, pre-production aircraft G-ALFR, is being fitted with two 3,007-e.h.p. Napier Elands for a first flight in July and—subject to the award of a provisional C. of A.—the operation of scheduled freight services with B.E.A. early next summer. The second, prototype G-AFRD (at present fitted with Bristol Proteus), will be a test-bed for the Rolls-Royce R.B.109. Its proving work on the Proteus completed, G-AFRD should be flying

PROJECTION OF VISCOUNT SUCCESS

KLM

order

VISCOUNTS

Nine Viscount 800 aircraft have been ordered by KLM for operation on their European and Near East routes.
We believe that the link between the honoured traditions of KLM and the new era of turbo-prop flight will be of the greatest significance in the future of air transport.

The total number of Viscounts in service or on order has now reached 226, including four for use as 'executive' aircraft.

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CIVIL AVIATION . . .

with two of the new Rolls turbines in the second half of 1956.

Mr. Peter Masefield gives the following comparison between the existing Elizabethan, with Centaurus piston engines, and the "New Elizabethan," as he calls the projected version with production type Eland 4s.

	Eland 4	Centaurus
Take-off power	2 × 3,765 e.h.p.	2 × 2,625 b.h.p.
Normal cruising power	2 × 1,415 e.h.p.	2 × 1,200 b.h.p.
R.P.M.	11,500 r.p.m.	1,950 r.p.m.
Height	23,000ft	15,000ft
Normal cruising speed	315 m.p.h.	240 m.p.h.
Fuel consumption	227 Imp. gal/hr	145 Imp. gal/hr
Air miles per gallon	1.32	1.66
Weight of powerplant and fuel for 500 miles with full reserves	14,591 lb	15,687 lb

B.E.A. have not yet indicated whether it is their intention to convert the entire fleet of 19 Elizabethans to Eland power, and a final decision will presumably depend on the results of next year's freight trials with G-ALFR. The advantages of a wholesale conversion—notably, 1,100 lb more payload, 75 m.p.h. faster cruise, and greater passenger-appeal—would undoubtedly have to be weighed against the cost of re-engining, loss of revenue hours during conversion, and the limited remaining life of the aircraft.

NEW SERVICES APPROVED

THE M.T.C.A. announce Ministerial approval, after consideration of the Air Transport Advisory Council's recommendations, of the following scheduled air services:—

Airviews, Ltd.—An internal service between Manchester - Southampton - Isle of Wight (Bembridge) until October 30th, 1956 (April to October).

Airwork, Ltd.—An all-freight service between London Airport and Dusseldorf until May 31st, 1963; an inclusive tour service between London (Blackbushe) and Pisa until September 17th, 1955.

Aquila Airways, Ltd.—A normal scheduled service between Southampton Water - Genoa and/or Santa Margharita until May 31st, 1962.

B.K.S. Air Transport, Ltd.—The inclusion of optional staff stops at Leeds (Yeadon) and Bournemouth (Hurn) on the internal service between Newcastle and/or West Hartlepool and the Isle of Wight, together with an increase in frequency up to seven return flights per week.

Cambrian Air Services, Ltd.—The operation of Dakota aircraft on the route Cardiff and/or Bristol-Dinard until September 30th, 1962; an inclusive tour service between Cardiff and/or Bristol and/or Southampton and Lourdes until September 30th, 1955 (May to September).

Dragon Airways, Ltd.—An internal service between Stoke on Trent (Meir) and Ronaldsway (Isle of Man) until October 31st, 1961.

Don Everall (Aviation), Ltd.—An internal service between Birmingham (Elmdon) - Coventry (Baginton) (optional) - Bembridge (Isle of Wight) until October 31st, 1961.

Starways, Ltd.—An inclusive tour service between Belfast and Lourdes (Tarbes) until October 15th, 1956 (May 1st to October 15th).

Yeadon Aviation, Ltd.—An internal service between Leeds (Yeadon) and Ronaldsway (Isle of Man) until October 1st, 1961 (April to October).

BREVITIES

TASMAN Empire Airways made a profit of some £60,000 during the financial year ended March 31st, 1955 compared with a loss of £68,000 in the previous year. The improvement follows the replacement of Solents with DC-6s; during the first three months of the year the flying-boat services lost £30,000, whereas the DC-6s, operating for the remaining nine months, made a profit of approximately £90,000.

* * *

Douglas now hold orders for 86 DC-7C Seven Seas. The customer break-down reads as follows: Braniff, 7; B.O.A.C., 10; K.L.M., 10; Northwest, 8; PanAm, 33; S.A.S., 8; Sabena, 6; and Swissair, 4.

* * *

Models displayed by Piasecki at the Paris Show included H-21s in the colours of Sabena and New York Airways. The Belgian airline, however, has not yet concluded its comparative study of the Sikorski S-58 and the Piasecki H-21.

* * *

The first Hunting-Clan Viscount—G-ANRR—was introduced to scheduled service on the Company's Newcastle-Stavanger-Oslo route on June 17th. The Viscount is a second newcomer to the HCA "northern network"; Heron services, operated on Hunting-Clan's behalf by Dragon Airways, now connect Newcastle with both Glasgow and Manchester.

* * *

Twenty-four P.A.W.A. technicians will be attached to Turkish State airlines for the next three years under a new assistance project announced by the U.S. Foreign Operations Administration, which will bear 70 per cent of the cost. Details of a similar programme of aid for Pakistan International Airlines were published in *Flight* for June 3rd.

* * *

The Polish airline LOT took delivery of its first Il-14 on June 10th. A Warsaw report says that Il-14s will soon replace most of the Il-12s now serving the airlines of the "countries of the camp of peace" (the Soviet satellites).

* * *

Formation of a new Australian intra-State airline, Southern Airlines, Ltd., has been announced in Melbourne. Initially, the company is operating daily passenger and freight services between Melbourne and Echuca and Balranald with a single eight-seat Anson; it proposes, however, to acquire a fleet of three 12-seat Hunting Percival Prince Vs.

* * *

Returns published recently by the C.A.A. show that the United States has 660,449 holders of pilots' licences. Of this number, 311,659 have current medical certificates and are therefore counted as "active pilots." States with the largest totals of active pilots are California (40,707); Texas (20,202) and New York (18,717).

* * *

The London firm of J. Toubkin (7, Rugby Street, W.C.1) have been appointed U.K. agents for Farner-Werke, A.G., of Grenchen, Switzerland. Farner-Werke possess one of Switzerland's two aircraft factories and also operate a fleet of 30 aircraft on charter work; other activities include purchase and sale of aircraft and spares.

Panair do Brasil have opened a London ticket office at 29, New Bond Street, W.1 (Mayfair 4756/8).

* * *

T.W.A. have applied for C.A.B. permission to operate direct to London and Paris from five West Coast cities. If approved, the service would be flown by L.1049G Super Constellations, which, according to the airline, "may or may not fly a so-called Polar route but will be free to choose the most advantageous high-latitude course depending on winds or weather conditions."

* * *

Accompanied by other members of his company, Mr. J. R. D. Tata, chairman of Air-India International, Ltd., visited the Bristol Aeroplane Company on June 10th. Both the outward and the return journeys between London Airport and Filton were made in Britannias.

* * *

From July 1st frequency of service on Silver City's new Stranraer-Belfast vehicle-ferry will be increased from three to seven return flights daily. Since the inauguration of the service on April 6th the airline has received bookings for over 1,000 vehicles and 3,000 passengers. The number of S.C.A. ferry routes was increased to nine on June 17th with the opening of services between Birmingham and Le Touquet and between Liverpool and Belfast.

Mr. Eoin C. Mekie, C.B.E.

* * *

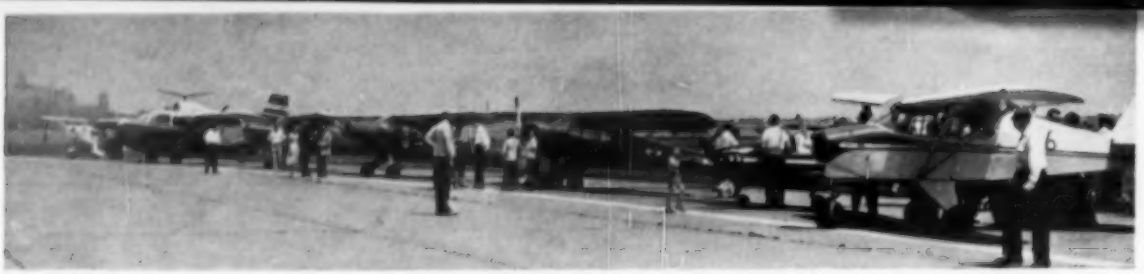
Services to civil aviation received scant recognition in the recent Birthday Honours. The most well-known name which appeared in the list was that of Mr. Eoin C. Mekie, chairman of Britavia, Ltd., who becomes a C.B.E. Mr. Mekie's citation did not, however, refer to his efforts for Britavia and its associated companies (energetic though these undoubtedly are), but mentioned only "political and public services in Woodmanston" (Mr. Mekie's home town).

* * *

Sabena announce the appointment of Mr. Guy Roberty as their operations manager at London Airport. His predecessor, Mr. Stocké, has been transferred to central administration, Brussels.

* * *

Lufthansa report that passengers flying on their European services can reduce their journey time by ten minutes or more by carrying their own baggage on and off the aircraft; baggage is stowed on shelves situated immediately aft of the cabin entrance door of the Convair 340. Access to these aircraft, incidentally, is through a door forward of the port nacelle *via* telescopic steps which are carried aboard the Convair. Passengers with a heavy luggage load can still have it stowed in the customary way.



Line-up for the Governor-General's Trophy Race at the Canadian International Air Show included a Seabee amphibian (see news item below).

CLUB AND GLIDING NEWS

ON the occasion of the Canadian International Air Show, at Island Airport, Toronto, on June 4th, the annual air race for the Governor-General's Trophy was won by Mr. Ford Auburn, a physical-education instructor at Riverdale Collegiate Institute. Competing in the race were seven aircraft (photograph above), ranging in size from a Seabee amphibian to Piper Cubs. The three laps of the 17-mile course were completed by Auburn in a Piper Cub at an average speed of 83 m.p.h. Mr. James Williams of Hamilton, flying a Piper Tri-Pacer at 128 m.p.h. was second, and Dorothy Rungeling of Fenwick flew her Piper Pacer into third place.

FIRST annual general meeting of the Surrey Flying Club took place at Croydon Airport on June 5th. The chairman, Mr. C. Nepean Bishop, reviewed the progress made since operations commenced some 13 months ago, when 75 members of the disbanded Redhill Club moved to Croydon with one Hornet Moth. Since then, he reported, membership had increased to 285; four Tiger Moths and a Messenger had been made available to members; and a further Tiger was being purchased. With the help of the Kemsley Flying Trust, a clubhouse had been built, and had been formally opened by the club's first patron, the Mayor of Croydon. During the 12 months ending April 30th, 17 first solos had been made, 14 of these pilots having gained their P.P.Ls. Hours flown totalled 1,452, compared with the target of 1,500.

London Control Zone restrictions, Mr. Bishop continued, made it impossible for the club to organize events similar to those in previous years at Redhill. Meetings of other clubs were well supported by the S.F.C., however, and in addition group flights to Shoreham and Southend had proved very popular. Alderman Monk, previously Mayor of Croydon, had now vacated his position as club patron, and Viscount Kemsley had kindly consented to accept this office.

At the meeting, the committee was re-elected with the additions of Mr. P. O'Dell and Mr. K. Smith. Strong representation from the Surrey Club is promised for the Flers Rally this weekend (June 25-26).

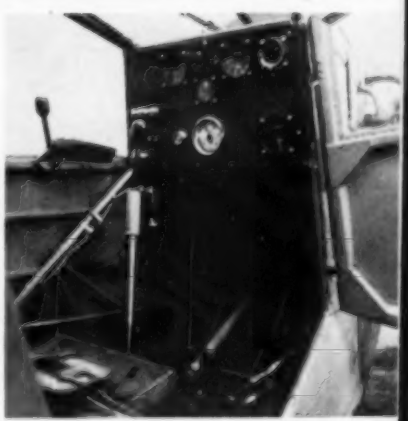
BLACKPOOL and Fylde Aero Club now have a total of 187 active flying members. The place on the flying committee of Mr. George Halliwell, who is now in Canada, has been taken by Mr. Stanley Gillaspy, an active flying member. Mr. Jock Neal of the Royal Singapore Flying Club has arrived to assist the club until August, when he returns to the Far East. Several first solos have been made recently, and six members obtained their private pilot's licences during the months of March, April and May.

The club is working in close co-operation with the Furness Aero Club, and provides the flying instruction and aircraft for the Barrow members at their Wallney Aerodrome base. A flying display is being arranged jointly between the two clubs at Wallney on July 3rd, and R.A.F. support has been promised for this occasion.

The club has now added an Ercoupe aircraft to its fleet, which now comprises eight distinct types of aircraft. Good progress has been made by the members of the English Electric Flying Club which is affiliated to the Blackpool Club, and Mr. Philip Stock has obtained a night rating to his P.P.L.

A FORMER Mayor of Cambridge, Capt. A. C. Taylor, has been elected president of the Cambridge Private Flying Group, which recently received the Masefield Trophy won by the group in the 1954 contest. Membership of the group is now about 70. After just over a year's operation, Tiger Moth G-ANLG has logged almost 400 hr. A recent P.P.L. was that obtained by Mr. Cyril Rowe. Hon. Secretary of the group is Mr. D. Hancock, 20 Stourbridge Grove, Cambridge.

STATED to be the first powered aircraft built in Germany since the war, the converted two-seat Doppelraab glider shown below has been fitted with a Volkswagen engine by Alfons Pützer of Bonn, and has been operating recently from Hangelar Airfield. The instructor sits in tandem behind the pupil, on a raised seat for improved visibility. He has a separate pair of rudder pedals, but must reach over the pupil's shoulder to hold the stick. The instructor also has access to all other controls, such as throttle and spoilers, from the rear seat. On the ground, care is needed when taxying due to the narrow-track undercarriage and wide span (13 metres), but assistance is provided by a steerable nose-wheel which can be locked for take-off.



The powered conversion of the Doppelraab glider, referred to above, which uses a 30 b.h.p. Volkswagen engine. Points of interest in the cockpit photograph are the nose-wheel steering arm, seen in the locked position between the floor-level stops; and the instructor's grip on the control column (above the pupil's normal-position grip).

Empty and maximum weights of the aircraft are 350 kg (770 lb) and 550 kg (1,210 lb) respectively, and fuel capacity is 40 litres (8.8 gall). Performance figures claimed for the new machine include: normal cruise, 110 km/hr (68 m.p.h.); take-off speed, 45-50 km/hr (28-31 m.p.h.); power-on endurance, 5 hr; take-off run in still air, 200 metres; and initial rate of climb 1.5 m/sec (5 ft/sec).

FORTHCOMING EVENTS

June 17-24. F.A.I.: General Conference.
June 20— July 1. I.A.S. and R.Ae.S.: Fifth Anglo-American Aeronautical Conference, Los Angeles.
June 24-27. Palermo Aero Club: Seventh Tour of Sicily.
June 25-26. Flers Aero Club: International air rally of Basse-Normandie.
June 25-26. Geneva Aero Club: "Fifty Years of Aviation": International air meeting.
June 25. R.N.A.S. Culdrose, Helston, Cornwall: Air Day.
June 25. R.N.A.S. Stretton, Warrington: Air Day.
June 26. Northern Heights M.F.C.: Model Flying Gala Day, R.A.F. Station Halton.
June 26. Yorkshire Aeroplane Club: At home.
June 28. Air League of the British Empire: Air Ball, Dorchester Hotel.
July 2. Elstree Flying Club: At home.
July 2. R.N.A.S. Arbroath, Angus, Scotland: Air Day.
July 2-4. R.Ae.C.: Members' La Baule rally.
July 3. Fair Oaks Aero Club: At home.
July 4. R.Ae.S. Halton Branch: "The Medical Aspects of Aircraft Engineering," by W/C. Latham.
July 7-10. Pescara Aero Club: Third Annunzio Trophy meeting.
July 7-9. Royal Aircraft Establishment, Farnborough: 50th Anniversary Celebrations.
July 9-11. Livorno Aero Club: Air rally.
July 9. R.N.A.S. Lee-on-Solent and Gosport (combined), Hants: Air Day.
July 9-11. R.Ae.C.: Members' Deauville rally.
Sept. 5-11. S.B.A.C. Show, Farnborough.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

Nearly airborne: Air Marshal Sir Dermot A. Boyle, A.O.C.-in-C. Fighter Command, being transferred by jackstay from "Apollo" to "Bermuda" during a recent visit he paid to the Home Fleet.

The New Second Sea Lord

THE Queen has been graciously pleased to approve the appointment of Admiral Sir Charles E. Lambe, K.C.B., C.V.O., to be a Lord Commissioner of the Admiralty, Second Sea Lord and Chief of Naval Personnel, in succession to Admiral the Hon. Sir Guy H. E. Russell. (See "I.D.C. Commandant" below.)

In the early part of his naval career Sir Charles was a torpedo specialist but since taking his civil pilot's "A" licence in 1929 he has held a number of air appointments. These include command of H.M.S. *Illustrious*; Assistant Chief of Naval Staff (Air); Flag Officer Flying Training; Flag Officer Commanding 3rd Aircraft Carrier Squadron and Flag Officer (Air) Home.

I.D.C. Commandant

AN announcement by the Ministry of Defence states that Admiral the Hon. Sir Guy H. E. Russell, G.B.E., K.C.B., D.S.O., has been appointed to succeed Air Chief Marshal Sir Arthur P. M. Sanders, K.C.B., K.B.E., as Commandant of the Imperial Defence College. He will take over on January 1st, 1956. Sir Guy has been Second Sea Lord and Chief of Naval Personnel for the past two years.

43rd C.F.S. Reunion

THE 43rd annual reunion dinner of the Central Flying School Association will be held in the officers' mess at Royal Air Force Station Little Rissington, Glos., on Friday, July 15th.

It is expected that approximately 120 guests will attend, including Air Marshal Sir John Baldwin, K.B.E., C.B., D.S.O. (retd.), president of the Association; Marshal of the R.A.F. Lord Trenchard, G.C.B., O.M., G.C.V.O., D.S.O., D.C.L., LL.D.; Marshal of the R.A.F. Sir William Dickson, G.C.B., K.B.E., D.S.O., A.F.C., Chief of the Air Staff; Air Marshal Sir Dermot A. Boyle, K.C.V.O., K.B.E., C.B., A.F.C., A.O.C.-in-C. Fighter Command; Air Marshal Sir James Robb, G.C.B., K.B.E., D.S.O., D.F.C., A.F.C. (retd), a past Commandant of the C.F.S.; and the present Commandant, A. Cdre. G. J. C. Paul, D.F.C. Many of the guests, including Lord Trenchard, will arrive by air.

The dinner will follow the annual general meeting of the Association, to be held on the afternoon of July 15th, and the annual inspection of Little Rissington by the A.O.C.-in-C., held on the previous day.

R.A.F. Rail Strike Effort

DURING the rail strike Transport Command aircraft carried nearly 1,000,000 lb of G.P.O. mail. Four Valettas flew regular daily flights between London and Bristol to Cardiff, Exeter, York, Newcastle and Edinburgh. They made 365 sorties, logging 223 flying hours.

O.U.A.S "At Home"

MARKING the near-ending of the summer term and preparations for moving to Middle Wallop for six weeks' summer camp, the Oxford University Air Squadron held its annual cocktail party at the unit's headquarters at Manor Road, Oxford.

Among the guests welcomed by the commanding officer, W/C. G. H. Nelson-Edwards, D.F.C., and members of the squadron were: The Senior Proctor and Mrs. P. D. Watson; Professor and Mrs. N. H. Gibbs; W/C. and Mrs. J. H. Heyworth; Col. and Mrs. T. J. Dacey, Base Commander, U.S.A.F., Upper Heyford; W/C. H. D. U. Denison, R.A.F. Brize Norton and Mrs. Denison; W/C. Botting, D.F.C., Upper Heyford, and Mrs. Botting; G/C. J. R. Morgan, O.B.E., and Mrs. Morgan; G/C. G. L. Cheshire, V.C., D.S.O., D.F.C.; Sir David Keir, Master of Balliol; Lord Cherwell; G/C. J. B. Gregor, M.R.C.S., L.R.C.P., Retd.; Rt. Rev. Mgr. A. V. D. Elwes, Honorary Chaplain, O.U.A.S.; the Rt. Rev. Mgr. R. L. Smith; and the Rev. R. S. E. Hinde.

Bonn Attaché

THE Air Ministry announces that A. Cdre. A. A. Adams, D.F.C., has taken up the post of Air Attaché at the British Embassy in Bonn.

A. Cdre. Adams was Assistant Air Attaché in Berlin from January, 1939, until the outbreak of war, and later, as Air Attaché at The Hague, he assisted with arrangements for the evacuation of the Queen and Government of the Netherlands after the German invasion. After commanding a bomber squadron he served as an observer with the United States 5th Fleet during the recapture of Guam.

R.A.F. Appointments

TWO appointments recently announced by the Air Ministry are those of A. Cdre. R. C. Storrar, O.B.E., to be A.O.C. No. 42 Group, Maintenance Command, and G/C. D. M. Somerville, O.B.E., who, with the acting rank of air commodore, becomes Director of Flight Safety at the Air Ministry.

A. Cdre. Storrar served before the war at Halton, in India with No. 28 Squadron, and at Boscombe Down; and in 1938 he graduated at the Staff College. At the outbreak of war he was serving in the Directorate of Organization. For the past 18 months he had been Director of Equipment (D).

A. Cdre. Somerville has spent 24 years in the Service. When war broke out he was commanding No. 112 (Fighter) Squadron in the Western Desert but towards the end of 1940 he returned to Britain and held a variety of appointments in Fighter Command. From 1951 to 1954 he commanded R.A.F. St. Eval.

R.A.F.A. Belfast Display

THE annual R.A.F.A. Air Display at R.N. Air Station Sydenham, Belfast, held on June 11th, was opened by Lord Wakehurst, Governor of Northern Ireland. Providing an international aspect were Thunderjets of the U.S.A.F. and a formation of Meteor 8s from the Royal Netherlands Air Force. A box formation of the latter, led by Major L. Verspoor, was outstanding.

R.A.F. participation included a Meteor team from No. 74 (Trinidad) Squadron at Horsham St. Faith (led by the commanding officer, S/L. W. J. Johnston, D.F.C.), and No. 502 (Ulster) Squadron R.Aux.A.F. (S/L. N. Townsend, D.F.C.) demonstrated an operational scramble.

Representing the Fleet Air Arm, a team from No. 807 Squadron gave an aerobatic display. The team was led by Lt-Cdr. P. J. Hutton, D.S.C., who commands the unit. Gannets and helicopters from Eglinton also took part.

The Queen's University Air Squadron put up a formation, and there was a demonstration—with dummy—of the Martin-Baker ejection seat. The parachutist Arthur Harrison made his 98th drop. S/L. H. L. Webb was the organiser of the display.

Three higher-command appointments in the Royal Canadian Air Force recently announced are those of Air Marshal F. R. Miller (left) as Deputy Minister of National Defence; A.V-M. H. L. Campbell (centre) to be Vice-Air Deputy at SHAPE; and A. V-M. H. B. Godwin to take over command of the R.C.A.F. Air Division serving with NATO in Europe.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Camels Preserved

AFTER reading Mr. P. G. Cooksley's letter on page 669 of the May 13th issue of *Flight*, headed "Camels Preserved," I wonder whether it might be of interest to point out that the machine has been masquerading since its recent restoration under a false serial number? This has been remedied during the past few months and the aircraft now bears its true N6812. The restoration was carried out by the R.A.F. who unfortunately returned the Camel for some reason with the wrong number and who have lately rectified the mistake.

Perhaps Mr. D. F. Taylor (Correspondence in the same issue) would like to know that the 1926 Westland-Hill Pterodactyl J8067 has been on show for some time past in the main ground floor hall of the Science Museum. This may be the one that he has in mind.

Finally, I should like you to know that the great deal of work that must have gone into your recent Military Aviation Number is certainly appreciated. It was a first-class issue.

South Benfleet, Essex. P. M. H. LEWIS.

High-speed Tunnels

FROM your lucid and concise description of Armstrong Whitworth's new high-speed tunnel [June 17th] it is apparent that this installation is one of the finest and most valuable in Europe. One point, however, does come to mind, and, as the cost of such tools is enormous—presumably falling entirely upon the taxpayer—it may be worth drawing attention to it.

You state "top and bottom of the working section were machined from iron castings," from which it seems clear that the floor and ceiling of the working section must be completely impervious to air. It can be concluded, therefore, that this tunnel does not employ the ventilated throat, which in America is considered to represent the greatest single advance in tunnel design in recent years. The principle is, briefly, that (in the original conception) longitudinal apertures were cut in the top and bottom of the throat and working section, so permitting air to bleed out of the tunnel proper and back again at the downstream end of the working section. A sealed box is, of course, attached over the slots, otherwise the working-section pressure could never be greatly different from ambient.

This simple ventilated throat has been found wholly to eliminate choking at any Mach number, including unity, assuming a reasonable size of model for the working cross-section.

A development of the idea is to employ fine perforations instead of slots. These holes, while rendering the same non-choking service, also create a "fuzz" of shocks along the floor and ceiling of the working section and tremendously reduce the strength of reflected shocks. From your description of the Whitley tunnel, it is clear that reflected shocks are still a problem to Armstrong Whitworth.

Perhaps Dr. Hilton would like to comment on whether he does, in fact, feel that his tunnel lacks any really advantageous features.

London, W.1. PROBER.

Indonesian Aircraft

IN your issue of May 13th , 1955, dealing with World Military Aviation, you stated on page 639:—"The first aircraft designed and built in Indonesia . . . designated NU-200 Sikumbang . . ." Here, I'm afraid, I must disagree with you. It is the third machine to be built and designed there; the first was the NWG-1, designed by Major Nurtani in 1946. It was an open-fuselage glider with a rectangular high wing, and was based on the Zögling type gliders. It was used as an evaluation machine for air-cadets; only six examples of this machine were built at the A.F. Base, Maospati, Madiun, Java.

The second machine was built in 1947 in the remarkably short period of five weeks (which time included the designing, constructing and test flying) by Air Vice-Commodore Wiweko Supono and was designated the Wiweko WEL-1.

This was a single-seat light parasol-winged monoplane powered by a 28 h.p. Harley-Davidson motorcycle engine driving a two-blade tractor airscrew.

May I take this opportunity of saying what a really worthwhile magazine you produce? I would also like to congratulate Mr. J. M. Bruce on his excellent articles on 1914-18 aircraft.

London, E.6. J. E. COURT.

THE INDUSTRY

Prizes for Bristol Apprentices

SPEAKING at the recent annual prize-giving to Bristol Aeroplane Company apprentices Mr. Peter Masefield, chief executive of B.E.A., said: "I can say with all sincerity that you have chosen about the most fascinating, and in these days the most valuable, field of contribution to human progress."

Mr. Masefield, who had arrived from Gatwick in a B.E.A. Sycamore, said that the next ten years in engineering, and especially in aviation, might be the most important since the industrial revolution. "I think our job is to make sure that we are fully equipped for it," he said.

"Here in Bristol," he continued, "is perhaps the most important civil aircraft of this age. The importance of the Britannia is tremendous. I think that it will be one of the best airliners in the world for the next decade."

Mr. Masefield had been introduced by Sir Reginald Verdon Smith, Bristol chairman and managing director, who told the audience (which included representatives of local educational bodies as well as apprentices and their parents) that next year's prize-giving would be held in the company's new apprentices' school. The report of the year's activities was presented by the principal of the school, Mr. E. G. Sterland, who said that it had been a busy and successful year. The number of apprentices under training had risen to 1,126 in 1954 and was probably about a hundred greater now.

Mr. Peter Masefield, at Filton, presents Sir Stanley White's Prize, for fifth-year aero engine apprentices, to M. R. Williams.

Towards More Efficient Production

THE first issue of a new quarterly publication—*Materials Handling News*—will be published on July 1st by *Mechanical Handling*. The new journal deals with all types of labour-aiding machinery, and is mainly intended for the many firms which still do not make the maximum use of mechanical handling.

This issue will show, among other things, the saving in money and man-hours to be gained by efficient mechanization.

Materials Handling News is to be published quarterly; potential users who wish to receive copies should write to Dorset House, Stamford Street, London, S.E.1.

IN BRIEF

Cellon, Ltd., of Kingston-on-Thames, announce that Mr. Aubrey Wallace Barr, M.A.(Oxon.), has been appointed to the Board. Mr. Barr has already spent several years in various departments of the company, and his acceptance of a position on the Board is particularly appropriate when it is recalled that his father, the late A. J. A. Wallace Barr, founded the company as far back as 1911.

* * *

A noteworthy export order has just been secured by Valay Industries, Ltd., of 186 Campden Hill Road, London, W.8, makers of "Wadpol" aircraft polish (described in *Flight* of August 20th, 1954): they have been asked to supply, urgently, 20 gallons of "Wadpol" for use on the President's Super Constellation. The preparation has full U.S.A.F.E. approval, and in this country is approved under D.T.D.900; it was originally formulated in 1950 for use on the Vickers Viking aircraft of the King's Flight.

Marconi Multi-Channel VHF Aircraft Communication Equipment

TYPE AD 115

The type AD 115 equipment is a remotely controlled transmitter/receiver which provides:

- 140 transmission and reception channels, 100 kc/s apart, in the frequency range 118-132 Mc/s.
- Transmission and reception on same or different frequencies.

Features include

- Direct reading frequency scales on the controller to ensure rapid channel selection.
- No valves or crystals in the controller.
- High powered transmitter provides 12-20 watts output power throughout the band.
- Special crystal economiser circuits which enable 24 crystals to provide 140 channels.
- Efficient squelch circuit to eliminate receiver noise when no signal is received.
- Full metering facilities for stage checks to enable rapid servicing.
- Accessibility of sub-assemblies.

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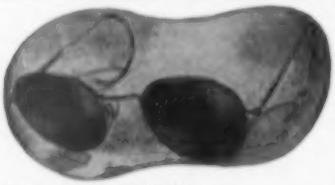

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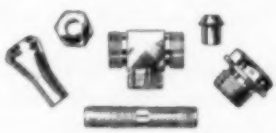

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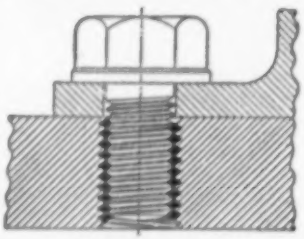

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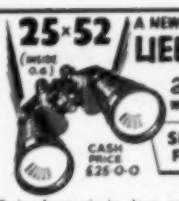

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Please send full particulars of experience to **Box No. AC 06682, Samson Clark & Co., Ltd., 57/61 Mortimer St., London, W.1.**

PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate Scheduled Air Services:—

FROM British European Airways, of Keyline House, Ruislip, Middx.:—

APPLICATION No. 483 for permission to include an optional traffic stop at Gothenburg on the Normal Scheduled Service which they operate between London and Stockholm on the route set out as Route No. 27 in Schedule 'A,' Part II of the Terms of Reference issued to the Council by the Minister of Civil Aviation on 20th July, 1952.

APPLICATION No. 267/1 for an amendment to the terms of approval of the Normal Scheduled Service which they are authorised to operate between London and Bergen for the period up to 30th April, 1962, so as to permit the inclusion of an optional traffic stop at Stavanger.

FROM Hunting-Clan Air Transport, Ltd., of 5 Fitzhardinge Street, London, W.1:—

APPLICATION No. 203/1 for permission to include Aden as an optional traffic stop on the area to area All-Freight Services between Airports in the United Kingdom on the one hand and various authorised traffic points in East, Central, West and South Africa on the other hand, which the Company have been approved to operate for the period up to 22nd February, 1965.

APPLICATION No. 321/1 for an amendment to the terms of approval of the Colonial Coach Service which they are approved to operate between London and Gibraltar at a frequency of one return service each 28 days during the period up to December, 1956, so as to operate at a frequency of one return service each fortnight.

APPLICATION No. 40/4 from Airlines (Jersey) Ltd., of the Parade, St. Helier, Jersey, Channel Islands, for permission to operate where appropriate and for the remainder of the periods of approval Dakota aircraft in addition to the aircraft types already authorised on all the U.K. Internal and Normal Scheduled Services which the Company has been approved to operate by the Minister of Transport and Civil Aviation.

APPLICATION No. 43/3 from Airwork, Ltd., of 15 Chesterfield Street, London, W.1, for permission to include Blantyre as a traffic stop on the Colonial Coach Service which they are at present approved to operate between London and Salisbury (Southern Rhodesia).

APPLICATION No. 487 from Derby Aviation, Ltd., of Derby Airport, Burnaston, Derby, for a Normal Scheduled Service with Dakota and/or D.H.89 aircraft for the carriage of passengers, supplementary freight and mail, on the route Derby-Nottingham (Tollerton)-Birmingham (Elmdon)-Ostend, at a frequency of up to three return flights daily during the season May to September inclusive each year, for a period of seven years from the date of approval.

FROM Eagle Aviation, Ltd., of 29 Clarges Street, London, W.1:—

APPLICATION No. 484 for a Seasonal Normal Scheduled Service with Viking and Dakota aircraft for the carriage of passengers, supplementary freight and mail, between Manchester (Ringway) and Palma, at a frequency of from one to seven services weekly during the season from May to October inclusive each year for a period of 10 years, commencing 1st May, 1956.

APPLICATION No. 485 for a Seasonal Normal Scheduled Service with Viking and Dakota aircraft for the carriage of passengers, supplementary freight and mail between Birmingham (Elmdon) and Palma at the same frequency and for the same period as Application No. 484.

APPLICATION No. 486 for a Seasonal Inclusive Tour Service with Viking and Dakota aircraft, in conjunction with Wenger Airtours, Ltd., for the carriage of passengers and supplementary freight between London (Blackbushe) and Alicante, at a frequency of from one to four services weekly during the season from May to October inclusive each year, for a period of seven years, commencing 1st May, 1956.

FOR the following Inclusive Tour Services to be operated with Dakota and Viking aircraft, in conjunction with Sir Henry Lunn, Ltd., at a frequency of up to four return flights weekly in each case for a period of seven years, commencing Spring 1956:—

APPLICATION No. 482 for a service between London (Blackbushe) and Pisa (San Guiste), during the season from May to October inclusive each year.

APPLICATION No. 488 for a service between London (Blackbushe) and Venice (Treviso or San Nicolo), during the season from April to October each year.

APPLICATION No. 489 for a service between London (Blackbushe) and Munich, during the season from April to October inclusive each year.

APPLICATION No. 490 for a service between London (Blackbushe) and Hamburg, during the season April to October inclusive each year.

APPLICATION for 491 for a service between London (Blackbushe) and Basle, during the season from April to October inclusive each year.

APPLICATION No. 492 for a service between London (Blackbushe) and Turin, during the seasons from April to October and from mid December to March inclusive each year.

FROM Transair, Ltd., of Croydon Airport, Surrey, for the following Inclusive Tour Services, to be operated with Dakota aircrart, in conjunction with Sky Tours, Ltd., for the carriage of passengers and supplementary freight, during the season from May to October inclusive each year, for the period 1st May, 1956 to 30th October, 1960:—

(Continued in column 1, page 34)

DESIGNERS & DRAUGHTSMEN

are invited to apply for a number of interesting vacancies with

THE ENGLISH ELECTRIC CO's GUIDED WEAPONS DIVISION at STEVENAGE, and LUTON

as follows:—

DESIGNER DRAUGHTSMAN
for design and layout of high efficiency light alloy structures. Good knowledge of materials and manufacturing technique is essential. Ref. 2810.

DETAIL DRAUGHTSMAN
for light mechanical work associated with aircraft structures and installation of special components. Knowledge of electrical and hydraulic systems an advantage. Ref. 2811.

DESIGNER DRAUGHTSMAN
for design of experimental rigs to test high efficiency light alloy structures. Applicants should be able to do simple stressing and be qualified to at least O.N.C. (Mech.) standard. Progressive appointments assured to man of ability.

DESIGNER DRAUGHTSMAN
for work on precision electro/mechanical instruments and gyroscopes. Experience of design for close tolerance manufacture or die casting an advantage. Ref. 1494.

DRAUGHTSMAN/CHECKERS
with approximately five years Drawing Office Service together with specialist knowledge in Electronic, Instrument, Electrical or Mechanical Engineering and Hydraulics. Ref. 2802.

These positions carry attractive salaries and promotion prospects and are pensionable after qualifying period. Successful candidates from the Greater London Area can be given housing assistance.

Applications to:
Dept. C.P.S., 336/7 STRAND, W.C.2., quoting Ref: No. 1067B

PUBLIC ANNOUNCEMENTS

(*Continued from column 2, page 33*)

APPLICATION No. 493 for a service between London (Croydon/Gatwick) and Basle, at a frequency of three return flights per week.

APPLICATION No. 494 for a service between London (Croydon/Gatwick) and Venice, at a frequency of one return flight per week.

APPLICATION No. 495 for a service between London (Croydon/Gatwick) and Nice, at a frequency of two return flights per week.

APPLICATION No. 496 for a service between London (Croydon/Gatwick) and Stavanger, at a frequency of one return flight per week.

APPLICATION No. 497 for a service between London (Gatwick/Croydon) and Madrid, at a frequency of one return flight per fortnight.

APPLICATION No. 498 for a service between London (Croydon/Gatwick) and Barcelona, at a frequency of one return flight per fortnight.

APPLICATION No. 499 for a service between London (Croydon/Gatwick) and Biarritz, at a frequency of one return flight per week.

FROM Transair, Ltd., of Croydon Airport, Surrey, for the following Inclusive Tour Services, to be operated with Dakota aircraft, in conjunction with Horizon Holidays, Ltd., for the carriage of passengers and supplementary freight, during the season from May to October inclusive each year, for the period 1st May, 1956 to 30th October, 1960:—

APPLICATION No. 500 for a service between London (Croydon/Gatwick) and Alghero, at a frequency of two return flights per week.

APPLICATION No. 501 for a service between London (Croydon/Gatwick) and Perpignan, at a frequency of three return flights per week.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on 30th July, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [3894

PUBLIC APPOINTMENTS

MINISTRY OF SUPPLY, HEADQUARTERS, LONDON, require AERONAUTICAL ENGINEER to carry out technical investigations associated with handling of new aircraft, and to compile and edit Pilots Notes for aircraft accepted for service with Royal Air Force and Royal Navy. The work involves visits to aircraft manufacturers, R.A.F. and Experimental Units. Higher School Certificates (Science) or equivalent but possession of a degree, H.N.C. or equivalent qualification in Aeronautical Engineering may be an advantage. An up-to-date knowledge of aircraft and of turbine engines is essential coupled with an aptitude for clear and concise expression. Flying experience is desirable and experience as a test pilot, a flight test observer or a technical author would be an asset. Salary within Senior Experimental Officer range (minimum age 35) £1,065-£1,265. Women somewhat less. Application forms from M.I.N.S., Technical and Scientific Register (K), 26 King Street, London, S.W.1, quoting C 433/5A. [3895

TUITION

M.T.C.A. APPROVED COURSES

at the

London School of Air Navigation

in conjunction with

Airways Aero Association, Ltd.

for the
COMMERCIAL PILOT and INSTRUMENT RATING

ALSO Full-time coaching for all other professional Pilot/Navigator qualifications.
HOME-STUDY (correspondence) courses excellent alternative. Link, Briefing, Procedures, R/T, Airways, Type Ratings.
33 OVINGTON SQ., LONDON, S.W.3. KEN. 8221.
FLYING BASE: CROYDON AIRPORT. [0279

FREE! Brochure giving details of courses in all branches aero eng. covering A.F.R.Ae.S., M.C.A. exams, etc. Also courses for all other branches of engineering.—Write: E.M.I. Institutes, Dept. F26, London, W.4. (Associated with H.M.V.) [0964

TUITION

CIVIL PILOT/NAVIGATOR LICENCES

Contact the Principal for details of Classroom and Postal Tuition at:
AVIGATION LIMITED
30 Central Chambers, Ealing B'way, London, W.5.
Phone: Ealing 8949. [0249

SURREY Flying Club, Croydon Airport, M.C.A. approved for private pilots' licences. Open seven days a week. Croydon 7744. [0293

A.F.R.Ae.S., A.R.B.Certs, A.M.I.Mech.E., etc., on "no pass, no fee," terms; over 95 per cent successes. For details of exams and courses in all branches of aeronautical work, navigation, mechanical eng. write for 144-page handbook free.—B.I.E.T. (Dept. 702), 29 Wright's Lane, London, W.8. [0707

SOUTHEND-ON-SEA Municipal Air Centre and Flying School. Comprehensive flying training for all pilots' licences, ratings and endorsements. Special facilities for instruments, night flying and commercial pilot licences. No entrance fee or subscriptions. M.T.C.A. approved 30-hour course.
MUNICIPAL Airport, Southend-on-Sea, Essex. Rochford 56204. [0453

BRITAIN'S AIR UNIVERSITY CAN TRAIN YOU for an airline career. Hundreds of today's airline captains and key maintenance personnel are graduates of this famous establishment. Courses are available for Commercial and Airline Transport Pilots' Licences, Instrument Ratings and Maintenance Engineers' Licences.
FOR details of these and other courses apply to:—The Commandant, Air Service Training, Ltd., Hamble, Southampton. [0970

LEARN to fly for £26. Instructors' licences and instrument flying for £3/5/- per hour. Night flying £4/5/- per hour. Residence 5 gns. weekly. Approved M.C.A. private pilots' licence course. Specialized course for junior commercial pilot's licence. Wiltshire School of Flying, Ltd., Thruxton Aerodrome, nr. Andover, Hants. Tel.: Weyhill 352. [0253

AERONAUTICAL. Comprehensive full-time technical and practical training for careers in all branches of aviation engineering. Diploma course leads to interesting executive appointments in civil aviation design and development, draughtsmanship, maintenance, etc. Extended courses to prepare for A.F.R.Ae.S. and A.M.I.Mech.E. examinations. Write for prospectus to Engineer in Charge, College of Aeronautical Engineering, Chelsea, London, S.W.3. Flaxman 0021. [0019

D. NAPIER & SONS LTD.
LUTON AIRPORT

HEAT TRANSFER AND AIRCRAFT DE-ICING

A department working on new approaches to these problems invites applications from

ENGINEERS AND PHYSICISTS

interested in both theoretical and practical investigations.

Facilities for experiments include wind tunnels and "flying test beds".

Vacancies exist for both senior and junior personnel and for designers and draughtsmen.

Some experience in this field is desirable but not essential.

Apply to:—
DEPT. C.P.S., 336/7 STRAND, W.C.2, quoting Ref. No. 1368M.

GLOSTER AIRCRAFT CO. LTD.
GLOUCESTER

HAVE VACANCIES ON SUPER-PRIORITY DESIGN AND DEVELOPMENT PROJECTS

FOR

AIRCRAFT DESIGN DRAUGHTSMEN
(SENIOR & JUNIOR)

Consideration will also be given to Draughtsmen with Mechanical, Structural or Electrical experience.

Also

STRESSMEN
(SENIOR & INTERMEDIATE)

for both strength and flutter calculations.

The conditions of employment are good with progressive salary, good sports and welfare facilities, pension scheme, etc.

APPLICATIONS STATING AGE, PREVIOUS EXPERIENCE AND EMPLOYERS SHOULD BE ADDRESSED TO THE

CHIEF DESIGNER

THE

LONDON DESIGN OFFICE

of

SHORT BROTHERS AND HARLAND LIMITED

has the following vacancies:

1. **SENIOR STRESSMAN** with experience of the different aspects of aircraft stressing. This is a Senior Staff position affording considerable scope and requires a willingness to accept responsibility.

Qualifications: A degree in engineering or H.N.C. in relevant subjects.

2. **STRUCTURAL DRAUGHTSMEN** for work on fuselage, wings, etc.

The prospects for these classes are good, as is the pay, and the work is of great interest.

Applications, which will be treated strictly confidentially, giving full details, including salary expected, to

The Manager, London Design Office
SHORT BROTHERS and HARLAND LIMITED
208A, Regent Street, London, W.1,
quoting S.A.67.

TECHNICAL INSTRUCTORS

required by

THE DE HAVILLAND AIRCRAFT COMPANY

in their

SERVICING SCHOOL AT HATFIELD

A comprehensive Aircraft Engineering background is necessary and also the ability to prepare instruction literature including drawings up to publication standard. Applicants must be capable of conducting courses on the servicing and maintenance of Airframes and/or Engines or Electrics and/or Radio.

Membership of the S.L.A.E. or the possession of the appropriate aircraft maintenance engineers' licences is desirable.

Applications, please, to:

The Personnel Manager
Dept. F
THE DE HAVILLAND AIRCRAFT COMPANY, LIMITED
HATFIELD, HERTS.

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through the local office of the Ministry of Labour and National Service, etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order 1952.

THE MULLARD RADIO VALVE CO., LTD.

has a number of vacancies for

Technical Assistants

in the following divisions at its Mitcham Factory:

Cathode Ray Tube Division,
Valve Making Division.
Semi-Conductor Division.
Valve Applications and Measurements Division.
Gas Discharge Valve.
and
Photo Electric Cell Division.

IN each field of work vacancies exist in the Production Development and Technical Departments. Applications are invited from persons holding the General Certificate of Education at Ordinary level in science subjects and at Advanced level, and others who possess either the Ordinary or Higher National Certificate in Electrical Engineering.

THE posts give an opportunity for further training in the electronic field and there are facilities for further study leading to higher qualifications. There are, in addition, considerable opportunities for promotion in varying and expanding fields of electronic work.

COMMENCING salaries will be according to age, experience and qualifications and can be considered progressive. There is a company pension scheme and long service holiday plan.

APPLICATIONS in writing, which will be treated with the strictest confidence, should be addressed to the Personnel Officer, The Mullard Radio Valve Co., Ltd., New Road, Mitcham Junction, Surrey, quoting reference JFG/TECH/GEN. [3873

ROLLS-ROYCE LTD. (SCOTTISH FACTORIES)

are setting up a

Design and Development Organisation For Jet Engines

At their new factory in the town of East Kilbride which is approximately 8 miles from Glasgow. This is a new project which will provide unlimited opportunities in the future and there are immediate vacancies for the following positions:

Development & Technical Service Engineers

Engine development for improved performance and extension of service life. Applicants should be of degree or equivalent standard with National Service completed, and preferably some previous experience in this type of work.

Design Draughtsmen

Applicants should have minimum technical qualifications of H.N.C. and have experience of engine or accessory design.

Detail Draughtsmen

Applicants preferably with H.N.C. and previous experience on aero engine or accessory work.

Housing Accommodation will be supplied after a probationary period of three months, during which time Subsistance Allowance will be paid.

Applications marked TE/20, giving full particulars of previous experience, qualifications, and salary required, to the Personnel Manager, Rolls-Royce, Ltd., Hillington, Glasgow, S.W.2, after which arrangements will be made to interview suitable applicants in their own area. [3876

RESEARCH AND DEVELOPMENT MANAGER

A LARGE firm in the Automotive Industry, which has been expanding rapidly since the war, requires a Manager for its Research and Development Organisation. The firm is within easy reach of London.

THE appointment at the level now under consideration is a new one, arising from a very recent reorganisation of the engine research and development activities. The man appointed will report directly to the Board. A man in his early 30's is preferred and an initial salary of £3,000 is offered.

THE post gives scope for managerial ability as well as technical creativity and involves the handling of a considerable staff. The research and development problems confronting the Company are being given the highest priority.

APPLICATIONS, which will be treated in complete confidence, should be sent to Box 4642. [3889

AQUILA AIRWAYS LIMITED

invite applications immediate vacancies:—

FIRST and Second Officers (minimum qualifications: Commercial Pilot's Licence, Instrument Rating and R/T Licence with practical navigation experience).

FLIGHT NAVIGATOR.

APPLY writing detailing experience to:

PERSONNEL OFFICER, 1 Great Cumberland Place, London, W.1. [3881

TECHNICAL AUTHORS AND ILLUSTRATORS

are required by

the

GUIDED WEAPONS DIVISION

of

THE ENGLISH ELECTRIC CO. LTD.

as follows:

1. **SENIOR TECHNICAL AUTHOR (ELECTRONIC),** for preparation of instructional and maintenance handbooks. Sound theoretical knowledge of electronics essential, together with the ability to write concise English.

2. **TECHNICAL AUTHOR (MECHANICAL)** with good general background in engineering and/or instruments.

3. **EXPERIENCED TECHNICAL ARTIST,** for quick and accurate production of perspective illustrations from engineering drawings.

These are permanent appointments offering attractive salaries to the right men. Employment will be at LUTON initially, later at STEVENAGE, HERTS. Housing assistance can be considered especially for successful applicants from the Greater London area.

Applications to:

DEPT. C.P.S.,
336-7, STRAND, W.C.2,
quoting Ref. 1392C

SITUATIONS VACANT

AERODYNAMICISTS, PHYSICISTS, MATHEMATICIANS AND ENGINEERS

A RAPIDLY expanding aircraft instrument firm engaged on the design and development of auto-pilots for aircraft and helicopters has vacancies for the following:
(a) Stability and Control Analyst.
(b) Flight simulator assessment of aircraft stability.
(c) Aircraft flight trials and equipment.

PREVIOUS experience in the aerodynamics or flight test department of aircraft or guided weapons industry desirable but not essential.

PLEASE apply giving full details of career and salary required (which will be treated in strict confidence): to Personnel Officer, Louis Newmark, Ltd., Prefect Works, Purley Way, Croydon, Surrey. [3892

RADIO OFFICERS

required
Temporary licence holders accepted for training. Apply
B.K.S. AIR TRANSPORT LIMITED,
1 Marylebone High Street, W.1.
Tel.: Hunter 9744.
[3877

TRAFFIC OFFICERS

Required.
Experience essential in ticketing and processing passengers.
Write stating particulars to:
B.K.S. AIR TRANSPORT, LTD.,
1 Marylebone High Street, W.1. [3878

APPLICATIONS are invited from Draughtsmen-Designers experienced in electro-mechanical equipment, mainly for aircraft. Excellent working conditions in pleasant surroundings in South Wales, 24 miles from Cardiff and coast; alternatively, in Nottingham or Reading. Apply, giving full particulars, to Chief Engineer, Teddington Aircraft Controls, Ltd., Cefn Coed, Breconshire. [3898

SITUATIONS VACANT

AIRCRAFT CHARGE HANDS

licensed "A" and "C" on Viscounts, Vikings, or York, required by
FIELD AIRCRAFT SERVICES,
London Airport. [3846

ENGINEERS required for work in the Lebanon.

ONE licensed A. & C. York Engineer.

ONE licensed Radio Engineer.

ONE experienced Engine Fitter on Merlins.

GOOD salary and overseas allowance.

WRITE giving full particulars in the first instance to Box No. 4715. [3902

ELECTRICIANS

Several Electricians required on Aircraft installation work. Although previous experience on modern aircraft is desirable—applications are welcome from Naval and R.A.F. electricians—all men who are capable of high class installation work are invited to apply. Good rates and all facilities. Call or write Personnel Officer,

HAWKER AIRCRAFT LTD.,
SUTTON LANE,
LANGLEY (near Slough), BUCKS.

SITUATIONS VACANT

SKYWAYS, LTD., require the following staff:

1. Licensed aircraft engineer for Germany. Must hold A.R.B. "A" and "C" licences covering Dakota and Consul aircraft.
2. Licensed aircraft engineers at Stanstead Airport. "A" and "C" licences covering York aircraft essential. Applicants must be prepared to move overseas if required.
3. "A" and "B" licensed radio engineer for Germany.

GOOD salaries and allowances. Write with full details to Personnel Manager, Skyways, Ltd., Stanstead Airport, Essex, quoting P.3. [3874

OVERSEAS. Canal Zone. International Aeradio, Ltd., require:—
1. Aircraft Engineer Officer, £1,151-£1,469.
2. Assistant Engineer airframe, £917-£1,235.
3. Assistant Engineer engines, £917-£1,235.
4. Assistant Engineer electrical, £917-£1,235. Recent experience modern R.A.F. piston and turbine aircraft licences desirable but not essential.
5. Marine Officer for operation Flying Boat base, £917 to £1,235.
6. Stores Supervisor, R.A.F. experience, £1,023-£1,341.

INCL. starting salaries shown, single-married (accompanied). Increments. Furnished quarters free. Emoluments tax free. Child allowance £51 each. Air fares paid. Pension/Insurance Scheme. Home to work transportation free. Write Personnel Officer, 40 Park Street, London, W.1. HYD. 5024. [3870

REQUIRED for Nottingham, estimator with aircraft experience used to production work, and in particular component assembly. Write full particulars in chronological order to Box F 590, L.P.E., 55 St. Martin's Lane, W.C.2. [3884

PILOT. Not more than 35 years. Experienced twin engine captain with Senior Commercial or Commercial and Instrument Rating, wanted for home and overseas service on aerial survey. Apply Hunting Aerosurveys, Ltd., 6 Elstree Way, Boreham Wood, Herts. [3880

RADAR type ASV Mark VI C

Three complete sets slightly used, together with considerable quantity of spare parts for same, and different types of aircraft instruments with spares

All of British manufacture. *For sale at extremely favourable prices*

Please apply to

SCANDINAVIAN AIRLINES SYSTEM

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BROOKLANDS AVIATION LTD.

NORTHAMPTON

REQUIRE

ASSISTANT PRODUCTION ENGINEER

Experience on repair of Service aircraft essential. Good salary commensurate with ability and experience.

APPLY TO:

Brooklands Aviation Ltd.,
Buttocks Booth, Moulton,
Northampton.

AERONAUTICAL OPPORTUNITIES

A well-known firm in the aircraft industry is starting a new project in a London Office. It is anxious to recruit staff to form an Assessment Group.

Vacancies with unusual opportunities for rapid promotion exist to meet the following approximate requirements:

ASSESSMENT GROUP

GROUP LEADER Aged 30/37, Science or Engineering degree standard, experienced in aircraft, or G.W. project or assessment groups, with knowledge of performance and servomechanism problems and analysis of flight and laboratory tests. Personality is important.

SECTION LEADERS Ages 27/35, Science or Engineering degree standard, general experience as for Group Leader but to a lesser extent.

STAFF TO FILL THESE SECTIONS, with various capabilities from Computing to Honours degree in Science or Engineering.

The age groups specified are given for guidance only and need not deter candidates outside these limits.

Monthly staff appointments carry a compulsory Pension Scheme and Weekly staff a voluntary Superannuation Scheme.

Write in confidence, giving full details of age, previous experience, qualifications, etc., to:

Box No. A.C. 08408, Samson Clarks, 57/61 Mortimer Street, London, W.1.

SITUATIONS VACANT

PILOT required with commercial licence endorsed for Auster Aircraft.
SKYFOTOS, Lympne Airport, Kent. [3897

A VACANCY occurs for a Senior Planning Engineer to take charge of the Planning Office in a medium-sized aircraft and light engineering company in Buckinghamshire.
EXTENSIVE experience in machine shop and light metal work planning is essential.
THIS is a senior post. The successful applicant will be eligible to participate in profit sharing and pension schemes—in addition to receiving a generous salary. Box No. 4688. [3899

APPLICATIONS are invited for posts as Assistants to the top engineering executives of British Overseas Airways Corporation.
THESE appointments will provide first class practical experience of all aspects of Civil Aviation engineering on both the maintenance and project sides.
APPLICANTS should have a good University degree or equivalent technical diploma on engineering, some practical experience in the aeronautical field and preferably some administrative experience of the industry in at least junior managerial capacity. The salary will be in accordance with experience and qualifications. There is a contributory pension scheme.
APPLICANTS should be not more than 45 years of age although age is of less importance actually than apparently.
OUR own staff have been advised.

APPLICATIONS stating age, past and present posts held, qualifications and experience, should be sent to Chief Personnel Officer, Airways House, Brentford, Middlesex. [3867

EDGAR PERCIVAL AIRCRAFT, LTD., require a Technical Writer experienced in small commercial aircraft, for the preparation of manuals of an aircraft now under construction, and for other interesting projects. Reply giving full details of experience and salary required to the firm's London Office at 72 Chesterfield House, Curzon Street, London, W.1. [3887

DRAUGHTSMEN

There are a number of vacancies for Draughtsmen of varying degrees of qualifications and experience in the

DESIGN OFFICES

of

HAWKER AIRCRAFT LIMITED

KINGSTON-ON-THAMES

Work is available on various aspects of fighter aircraft design.

Airframe, Armament, Power Plant Installations, Fuel Systems, Cockpit Layouts, Flying Controls, Electrical and Hydraulic Installations.

Applications are invited from all Mechanical and Electrical Draughtsmen—from the young man who has just completed National Service to the senior experienced designer draughtsman.

Previous aircraft experience not necessarily expected. Every position is pensionable and the commencing salary and status for each appointment will be based on qualifications, experience and ability. Holiday arrangements for the year will be respected. Please write fully to

The Personnel Supervisor,
HAWKER AIRCRAFT LIMITED,
Canbury Park Road,
KINGSTON-ON-THAMES, SURREY.

SITUATIONS VACANT

A. V. ROE & COMPANY, LIMITED, have the following vacancy in their Technical School, situated at Woodford Aerodrome, Cheshire.
AN Instructor/Electrical is required for lecturing on aircraft electrics. Applicants should have served an apprenticeship as an electrician and have a knowledge of A.C. as well as D.C. Preference will be given to those having aircraft experience (including A/C instruments) and also to those who have done some instructing previously.
APPLICATIONS giving full details of age, experience and qualifications, also salary required, should be addressed to the Labour Manager, A. V. Roe & Co., Limited, Greengate, Middleton, Manchester. [3807

HELICOPTER Personnel required for overseas operations. Experienced helicopter commercial pilots, licensed "A" and "C" engineers and fitters. 5.55 experience preferred. Write Box 4546. [3866

REQUIRED, first class fitters airframe and/or engine. Experience Dove, Viking, Hercules, Queen 70 an advantage. Air Couriers, Croydon Airport. [3829

EXPERIENCED aircraft electricians required immediately. Good rates of pay. Single hostel accommodation available. Apply to: Personnel Manager, Skyways, Ltd., Stansted Airport, Essex, quoting P4. [3893

EDGAR PERCIVAL AIRCRAFT, LTD., require a Chief Inspector, and Inspectors at their works at Stapleford Tawney Aerodrome in Essex. Replies giving full details of experience and salary required must be addressed to the firm's London Office at 72 Chesterfield House, Curzon Street, London, W.1. [3888

A. & C. Licensed Engineer on Avro 19 Aircraft required to take charge of maintenance in a rapidly expanding operating company in Germany. Excellent prospects. Accommodation found for single man. Salary DM 800 per month. (11.34 DM to £1). Aero Exploration K.G., Frankfurt/M. Germany. [3901

DRAUGHTSMAN. Senior electrical installation draughtsman required. Interesting and progressive appointments. Pension scheme. Apply in writing to the Personnel Manager, The Fairey Aviation Company, Limited, Hayes, Middlesex, quoting reference D.O.7. [3853

AIRCRAFT Inspectors required for Major Assemblies, Final Erection and Flight Shed Work. Good pay and prospects for suitable men. Apply stating age and particulars of experience to: Personnel Officer, Hawker Aircraft (Blackpool), Ltd., South Shore, Blackpool. [3843

INSPECTOR, with good technical engineering background and drawing office experience required for compilation of overhaul and repair schemes on gas turbine aero engines. Applications, which will be treated in the strictest confidence, should include details of previous experience and be addressed to "Personnel Manager," Box 4556. [3868

DEVELOPMENT engineers and technicians required in research department of a well-known firm of precision engineers, particularly for work in connection with servo systems, small precision motors, and gyroscopic instruments. Apply stating age, experience and salary required to S. G. Brown, Ltd., Shakespeare Street, Watford, Herts. [0146

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The illustrations show some of the many examples of Lockheed undercarriages. Above is that on the 'Beverley', length from top to axle 185 in. At the extreme left is the undercarriage for the 'Air Horse', length from top to axle 197·6 in. Next is the Avro 707, 52 in. from top to axle.

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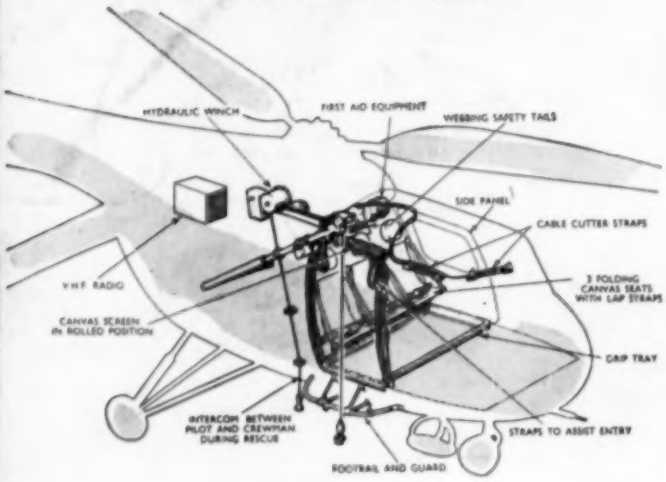

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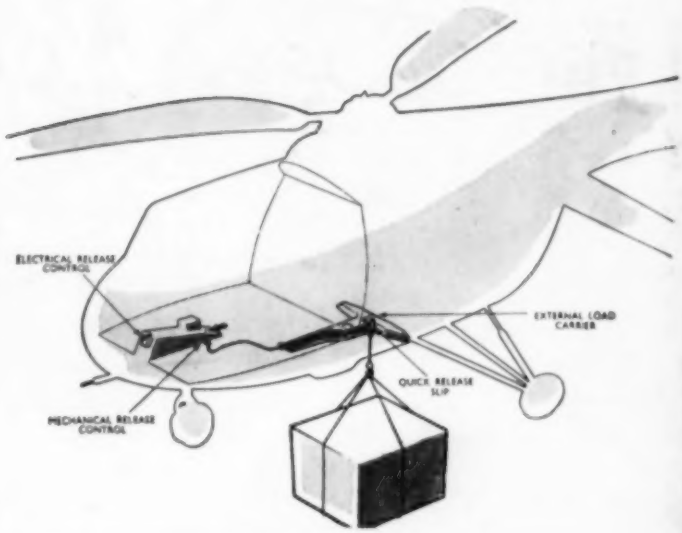

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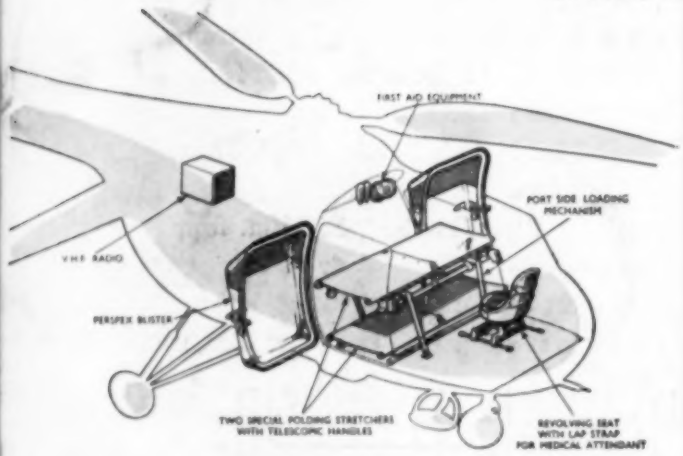
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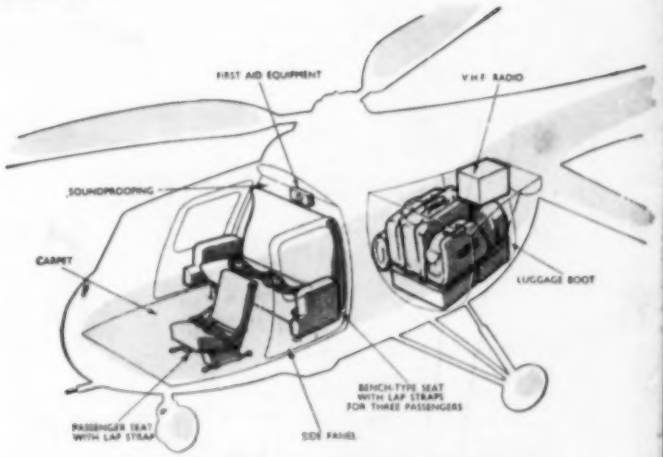

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